

The image shows a presentation slide titled "HCS 2010 Introductions". The slide has a light blue background with a collage of highway images and a hand pointing at a screen. The title "HCS 2010" is in the top left corner. The word "Introductions" is in a large, bold, blue font. Below the title is a list of participants and questions.

Introductions

- Tim White
- Brian Smalkoski
- Class participants
 - What module(s) in the HCS do you use most often?
 - What module(s) in the HCS do you rarely use?

2

Housekeeping

- Set phones to vibrate/silent
- Questions—ask lots of them at any time!
- Snacks available in the room
- Break
 - 2:30 – 2:45 pm

3

Day 1 – Interrupted Flow

- Overview
- Unsignalized Intersections
 - Two-Way Stop Control
 - All-Way Stop Control
- Roundabouts



4

Day 2 – Interrupted Flow

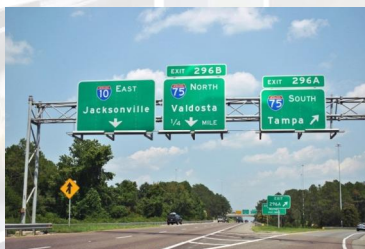
- Signalized Intersections
- Urban Streets
 - Segments
 - Facilities



5

Day 3 – Uninterrupted Flow (Mostly)

- Interchanges (uninterrupted flow)
- Freeways
 - Basic, weave, merge, and diverge segments
- Multi-lane highway segments
- Two-lane highway segments



6

Training Objectives

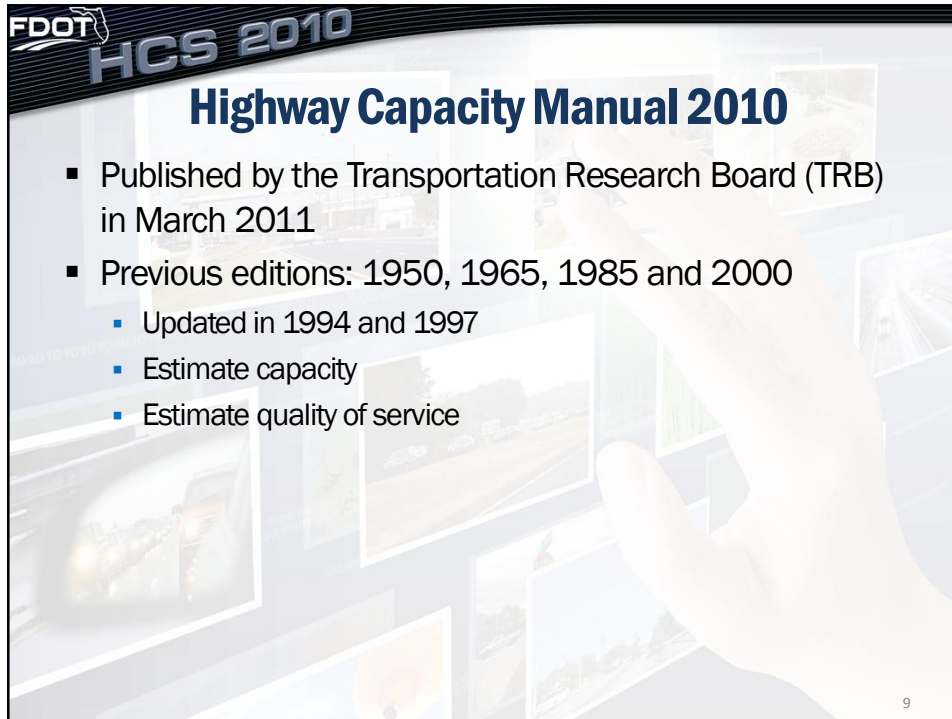
- To move beyond the basic concepts of traffic flow theory to hands-on capacity analysis, focusing on planning and operations
- To gain proficiency in capacity analysis through a range of exercises—from simple to complex
- To identify constraints of *HCS* through the analysis of over-capacity conditions
- To understand the factors that have the greatest impact on the results
- To identify some key changes between *HCM 2010* and *HCM 2000*

7

Format for Each Module

- Introduction to the module
- *HCM 2010* versus *HCM 2000*
- Required Data
- Limitations of the module
- Measures of Effectiveness (MOEs)
- Methodology
- Sample problem(s)
- Workshops

8

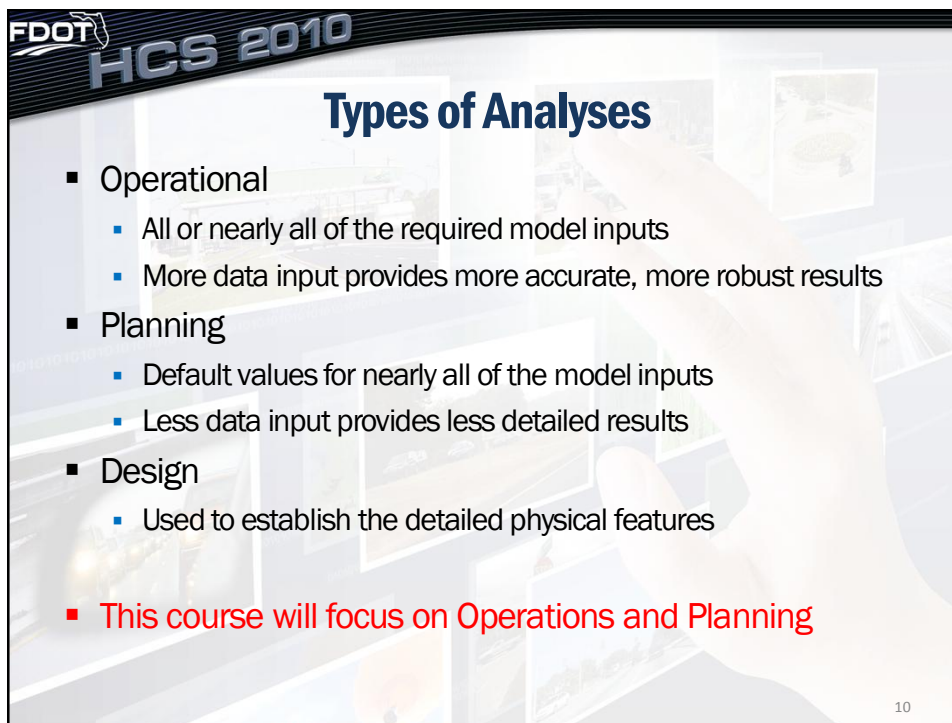


FDOT HCS 2010

Highway Capacity Manual 2010

- Published by the Transportation Research Board (TRB) in March 2011
- Previous editions: 1950, 1965, 1985 and 2000
 - Updated in 1994 and 1997
 - Estimate capacity
 - Estimate quality of service

9



FDOT HCS 2010

Types of Analyses

- Operational
 - All or nearly all of the required model inputs
 - More data input provides more accurate, more robust results
- Planning
 - Default values for nearly all of the model inputs
 - Less data input provides less detailed results
- Design
 - Used to establish the detailed physical features
- This course will focus on Operations and Planning

10

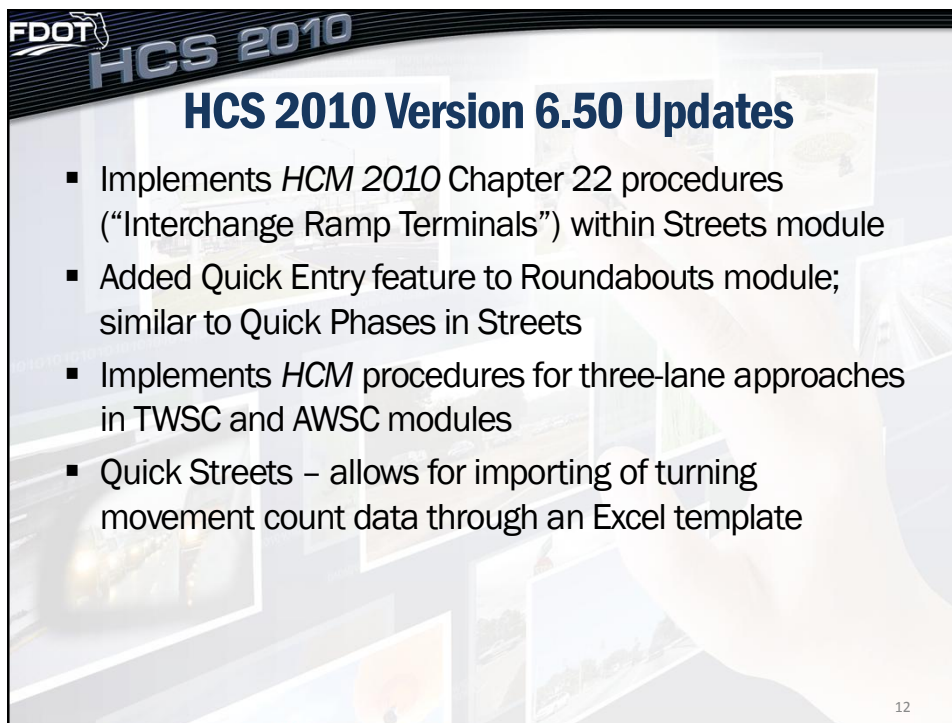


FDOT HCS 2010

Highway Capacity Software (HCS 2010)

- Implements *HCM 2010* procedures & methodologies
- Follows *HCS2000*, *HCS+* and *HCS+T7F*
- Features *CORSIM* Quick Animation
- Major overhauls
 - New Roundabouts module
 - Updated Weaving module
 - New Visual Mode in Streets module
 - New Interchanges module

11



FDOT HCS 2010

HCS 2010 Version 6.50 Updates

- Implements *HCM 2010* Chapter 22 procedures (“Interchange Ramp Terminals”) within Streets module
- Added Quick Entry feature to Roundabouts module; similar to Quick Phases in Streets
- Implements *HCM* procedures for three-lane approaches in TWSC and AWSC modules
- Quick Streets – allows for importing of turning movement count data through an Excel template

12

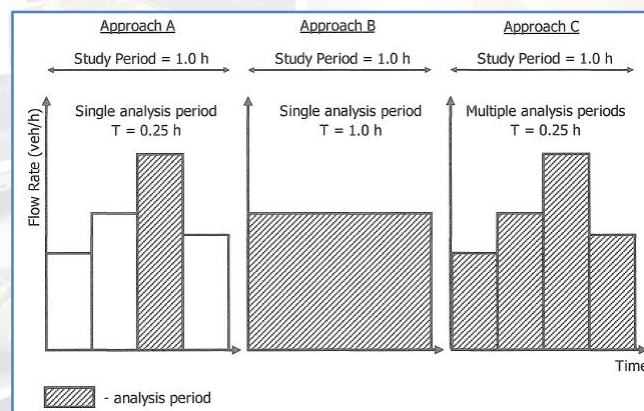
Study Period vs Analysis Period

- Study period
 - Time interval represented by the performance evaluation
 - Consists of one or more consecutive analysis periods
- Analysis period
 - Time interval evaluated by a single application of the methodology
 - Range: 0.25 to 1.0 hours
 - Longer durations sometimes used for planning analyses
 - Avoid analysis periods that exceed 1.0 hr, because traffic conditions are not steady for long time periods
 - If evaluation of multiple analysis periods is important, then results from each period should be reported

13

Study Period vs Analysis Period

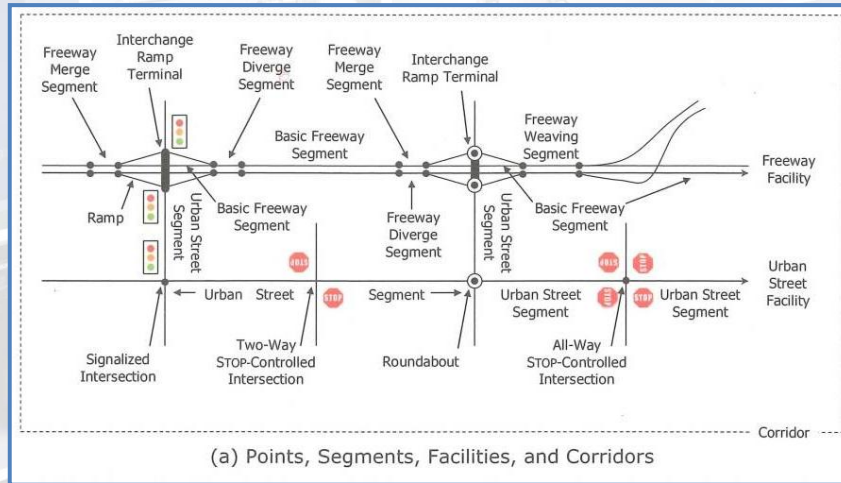
- Approach A is the recommended approach, which is based on the evaluation of the peak 15-minute period



14

Types of Roadway System Elements

- HCM 2010 Exhibit 2-1a (Roadway System Elements)



15

Day 1 – Interrupted Flow

- Overview
- Unsignalized Intersections
 - Two-Way Stop Control ◀
 - All-Way Stop Control
- Roundabouts

16

Two-Way Stop Control (TWSC)

- Chapter 19 – HCM 2010
- Major Street/Minor Street
- Isolated intersections
- Level of Service criteria
 - Minor-street movements
 - Major-street left turns
- Applicable to automobiles, pedestrians & bicyclists
- New in 2010: gap acceptance parameters for 6-lane streets have been added

17

TWSC

- HCM 2010 Exhibit 19-1 (LOS for Automobiles)

Control Delay (s/vehicle)	LOS by Volume-to-Capacity Ratio	
	$v/c \leq 1.0$	$v/c > 1.0$
0-10	A	F
>10-15	B	F
>15-25	C	F
>25-35	D	F
>35-50	E	F
>50	F	F

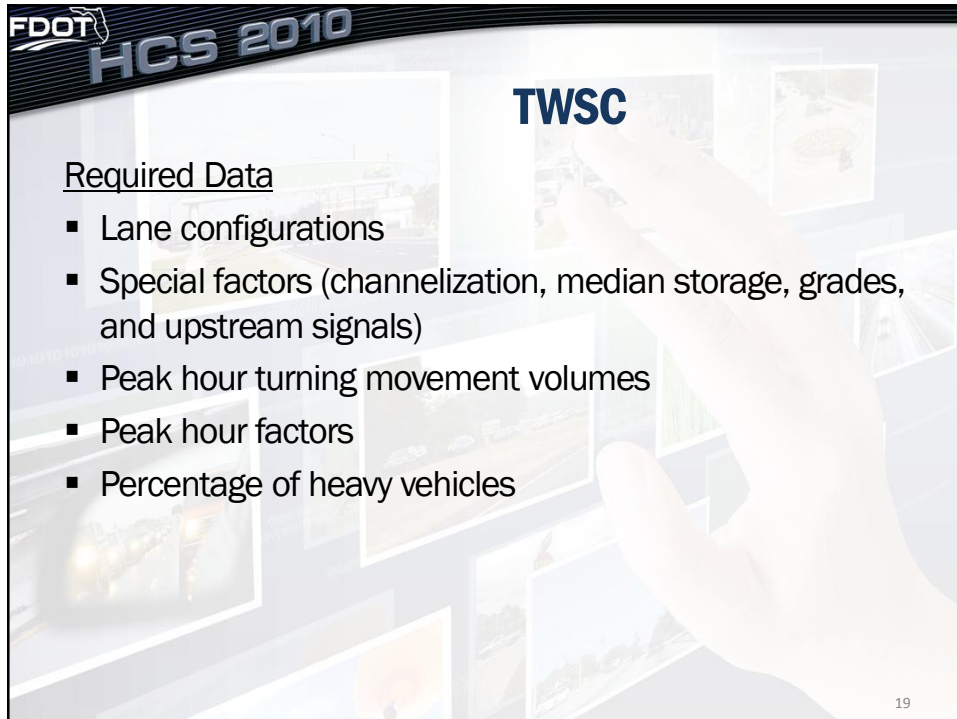
Note: The LOS criteria apply to each lane on a given approach and to each approach on the minor street. LOS is not calculated for major-street approaches or for the intersection as a whole.

- HCM 2010 Exhibit 19-2 (LOS for Pedestrians)

LOS	Control Delay (s/pedestrian)	Comments
A	0-5	Usually no conflicting traffic
B	5-10	Occasionally some delay due to conflicting traffic
C	10-20	Delay noticeable to pedestrians, but not inconveniencing
D	20-30	Delay noticeable and irritating, increased likelihood of risk taking
E	30-45	Delay approaches tolerance level, risk-taking behavior likely
F	>45	Delay exceeds tolerance level, high likelihood of pedestrian risk taking

Note: Control delay may be interpreted as s/pedestrian group if groups of pedestrians were counted as opposed to individual pedestrians.

18



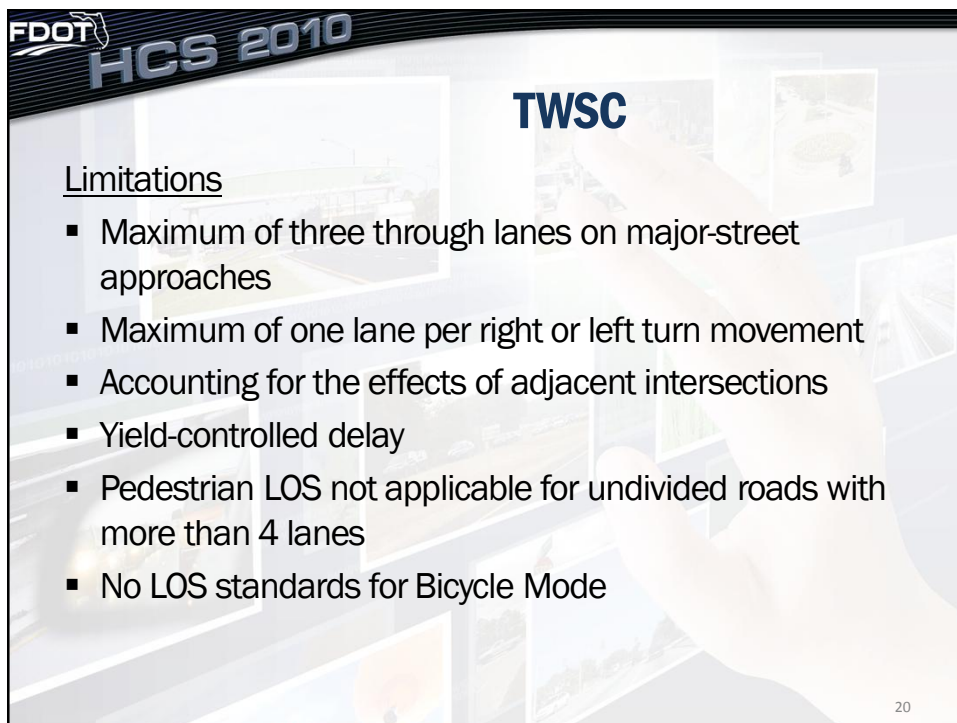
FDOT
HCS 2010

TWSC

Required Data

- Lane configurations
- Special factors (channelization, median storage, grades, and upstream signals)
- Peak hour turning movement volumes
- Peak hour factors
- Percentage of heavy vehicles

19



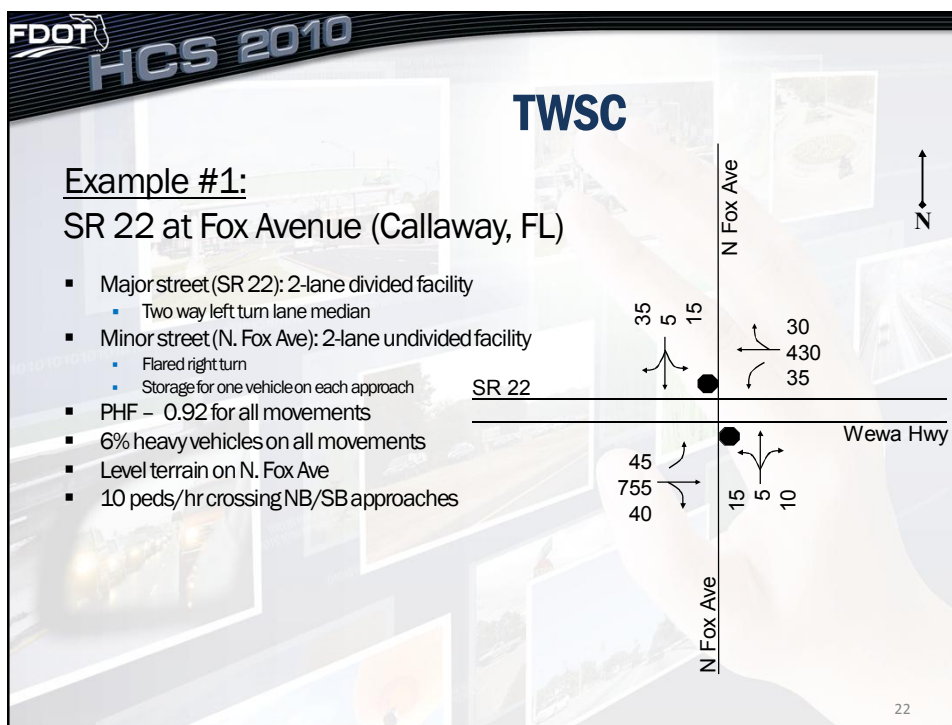
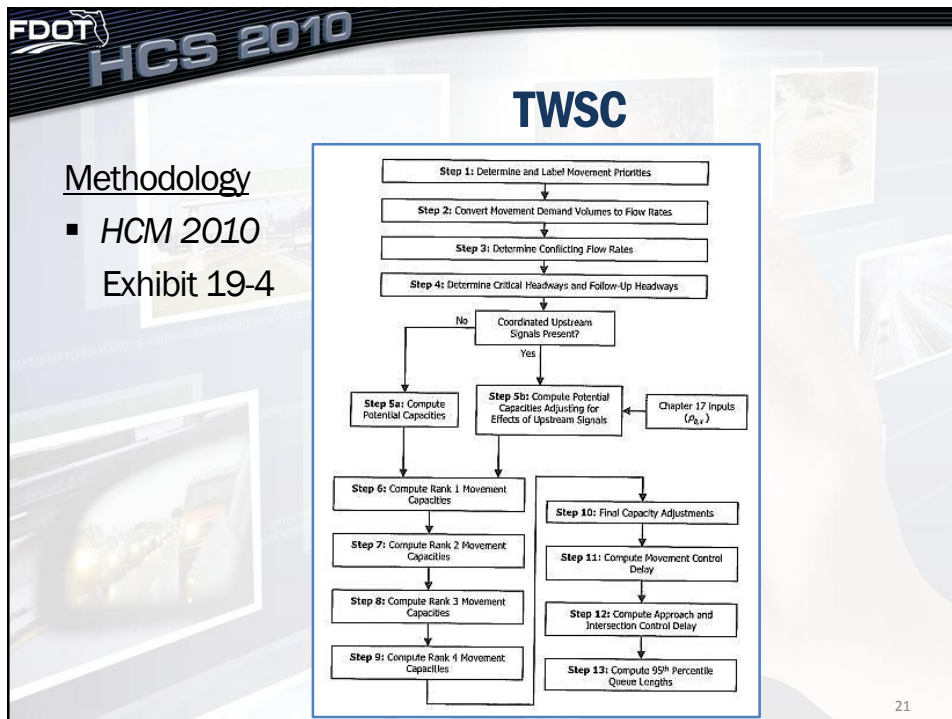
FDOT
HCS 2010

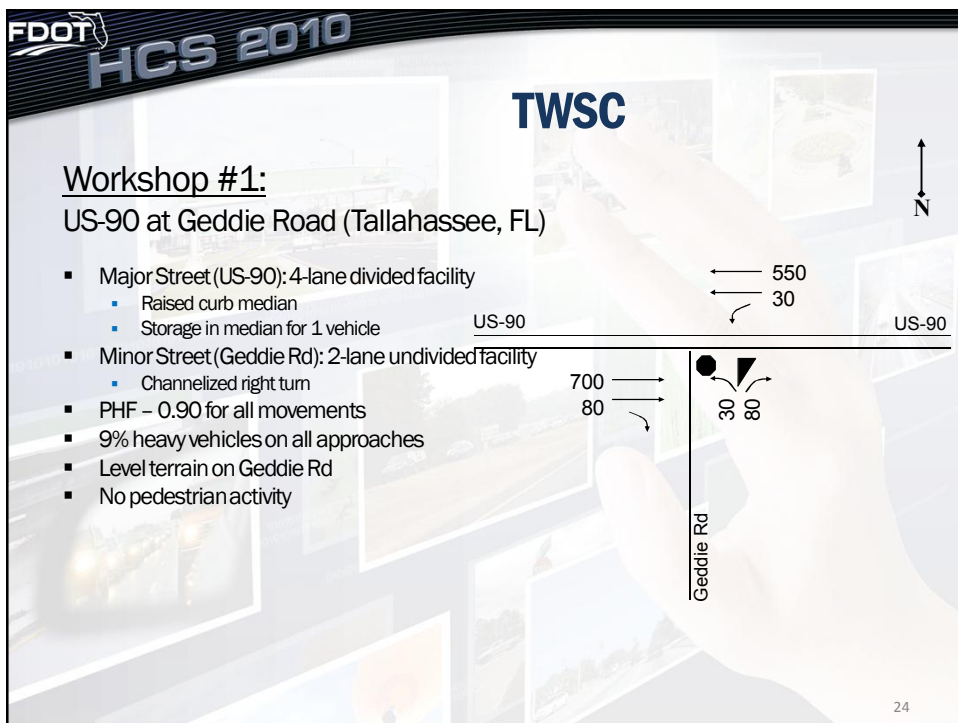
TWSC

Limitations

- Maximum of three through lanes on major-street approaches
- Maximum of one lane per right or left turn movement
- Accounting for the effects of adjacent intersections
- Yield-controlled delay
- Pedestrian LOS not applicable for undivided roads with more than 4 lanes
- No LOS standards for Bicycle Mode

20





TWSC



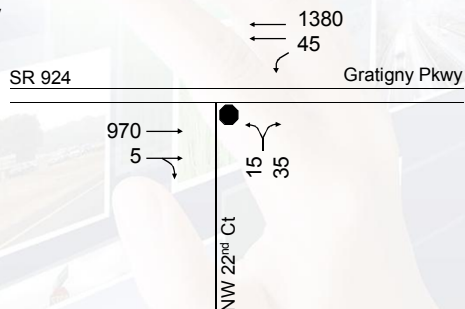
25

TWSC

Workshop #2:

SR 924 at 22nd Court (Miami, FL)

- Major street (SR 924): 4-lane divided facility
 - Raised curb median
 - Storage in median for 1 vehicle
- Minor street (NW 22nd Ct): 2-lane undivided facility
- 0.89 - PHF for all approaches
- 3% heavy vehicles on all movements
- Level terrain on NW 22nd Ct
- No pedestrian activity
- Upstream traffic signal (420' to the west)
 - 35 MPH progression speed
 - 120 second cycle length
 - Progressed volume - 850 vehicles/hr
 - Arrival type 5
 - Effective green - 45 seconds



26

FDOT HCS 2010

TWSC

Workshop #3:
Pine Crest Avenue at M.L. King Jr. Boulevard

- Pine Crest Ave (western leg): 4-lane divided facility
 - Free-flow channelized right-turn lane with receiving lane
 - Raised curb median with no storage
- Pine Crest Ave (eastern leg): 2-lane undivided facility
- Minor Street (ML King Jr. Blvd): 4-lane undivided facility
- PHF – 0.90 for all approaches
- 2% heavy vehicles on all movements
- No grades
- No pedestrian activity

27

FDOT HCS 2010

Day 1 – Interrupted Flow

- Overview
- **Unsignalized Intersections**
 - Two-Way Stop Control
 - All-Way Stop Control ◀
- Roundabouts

28

All-Way Stop Control (AWSC)

- Chapter 20 – HCM 2010
- Every vehicle required to stop
- Isolated intersections
- New in 2010: a queue estimation model has been added

29

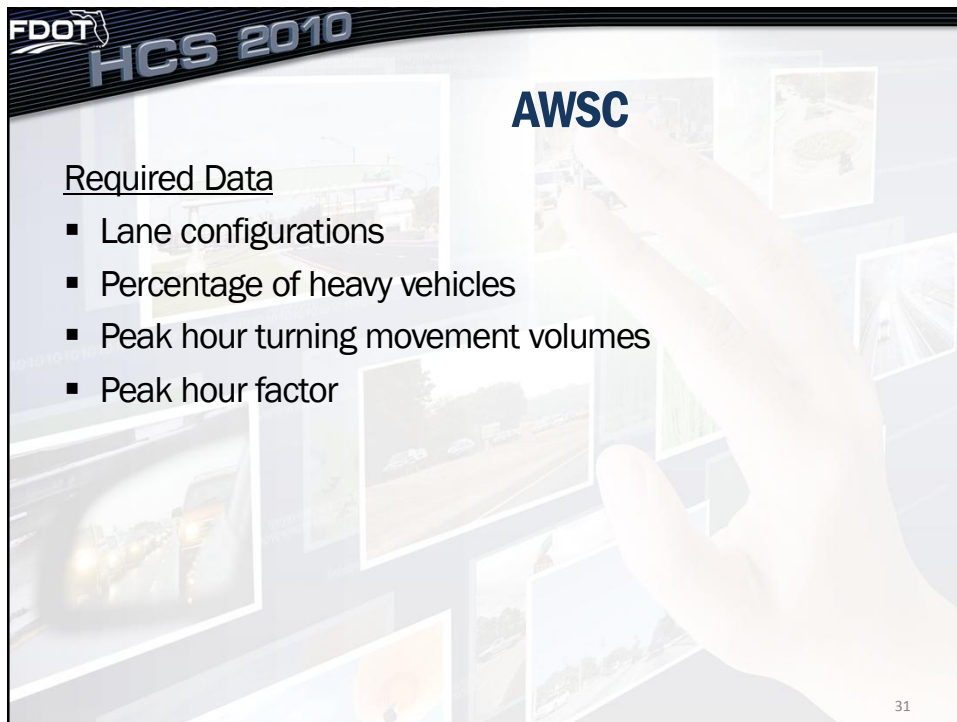
AWSC

- HCM 2010 Exhibit 20-2 (LOS for Automobiles)

Control Delay (s/veh)	LOS by Volume-to-Capacity Ratio*	
	$v/c \leq 1.0$	$v/c > 1.0$
0-10	A	F
>10-15	B	F
>15-25	C	F
>25-35	D	F
>35-50	E	F
>50	F	F

Note: * For approaches and intersectionwide assessment, LOS is defined solely by control delay.

30



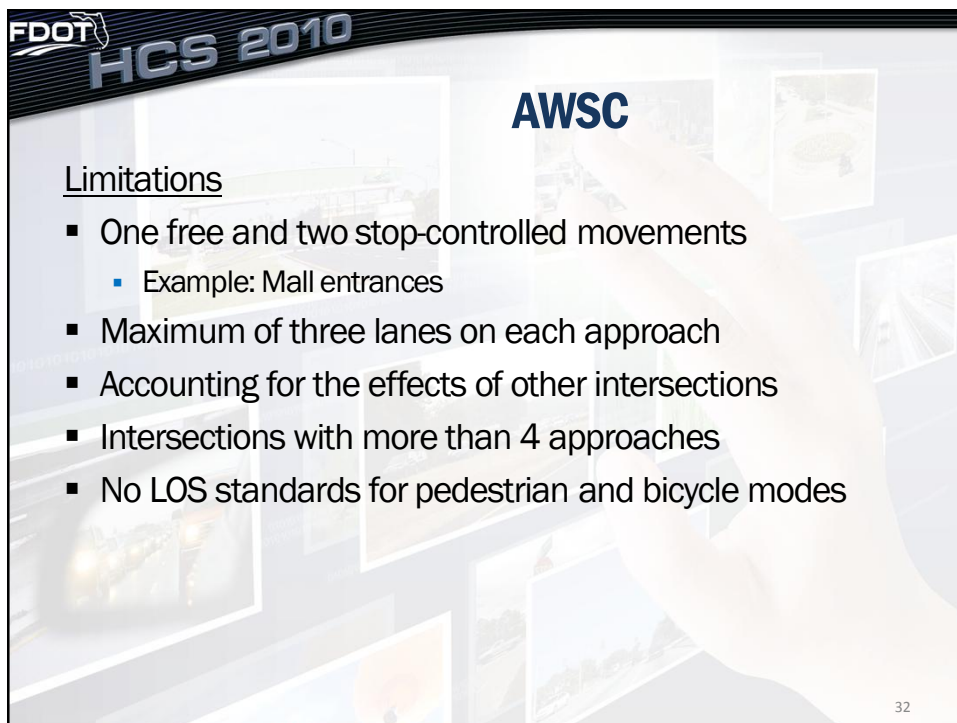
FDOT
HCS 2010

AWSC

Required Data

- Lane configurations
- Percentage of heavy vehicles
- Peak hour turning movement volumes
- Peak hour factor

31



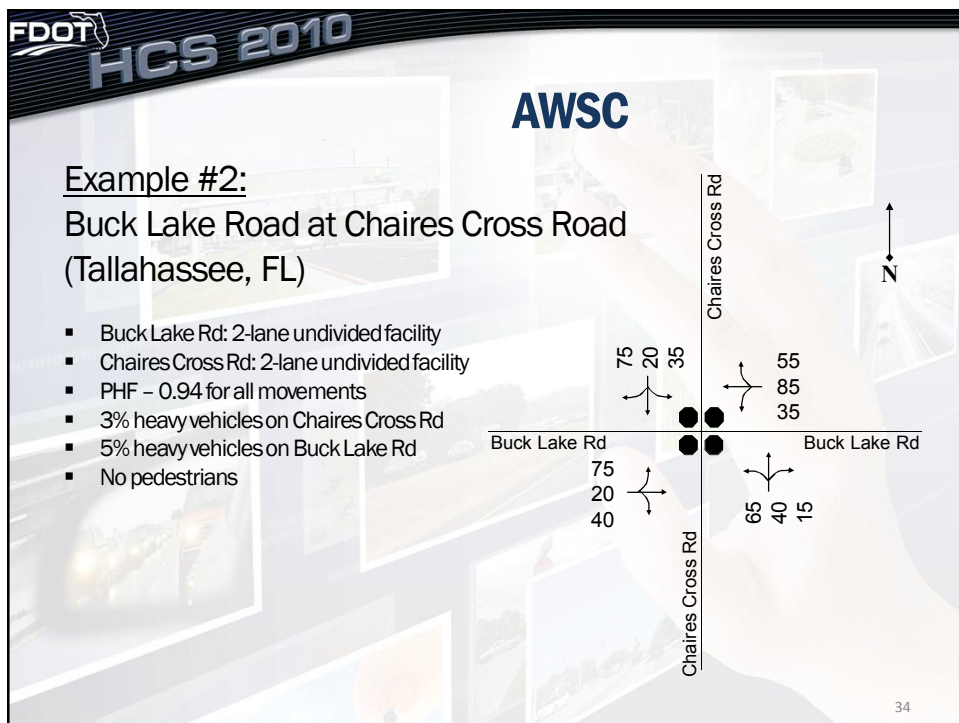
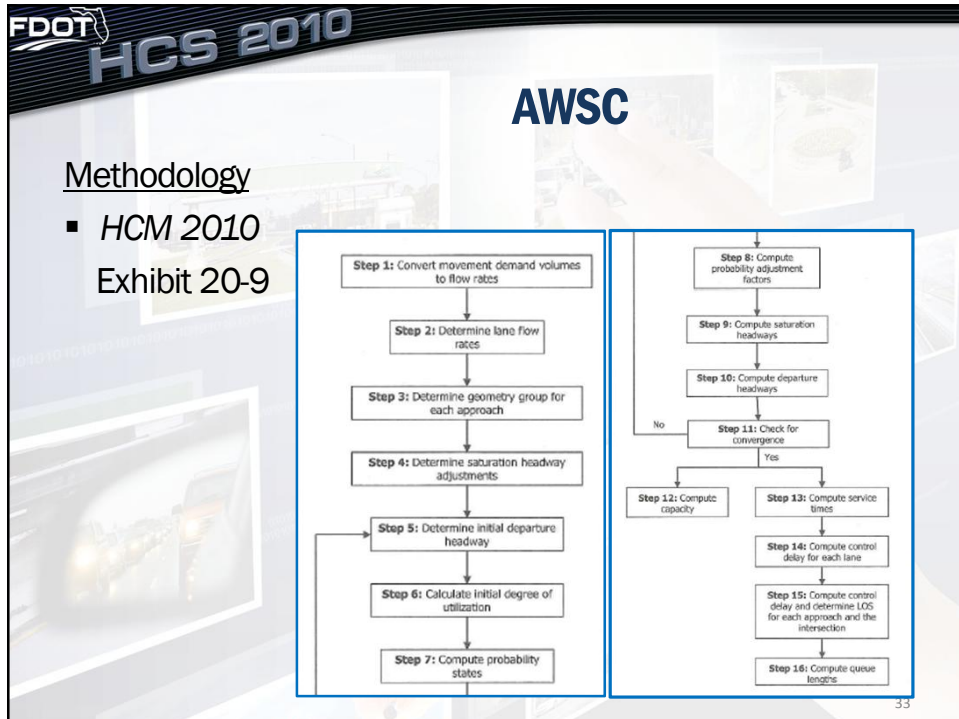
FDOT
HCS 2010

AWSC

Limitations

- One free and two stop-controlled movements
 - Example: Mall entrances
- Maximum of three lanes on each approach
- Accounting for the effects of other intersections
- Intersections with more than 4 approaches
- No LOS standards for pedestrian and bicycle modes

32



AWSC



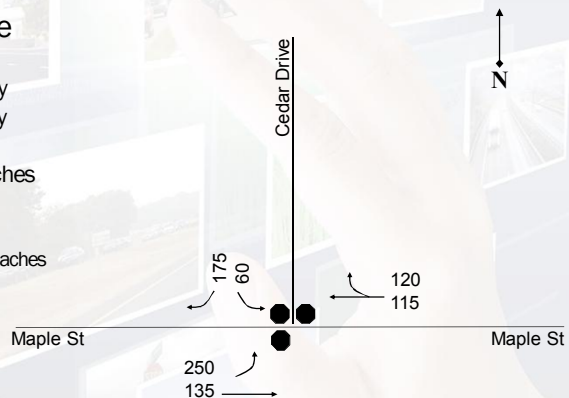
35

AWSC

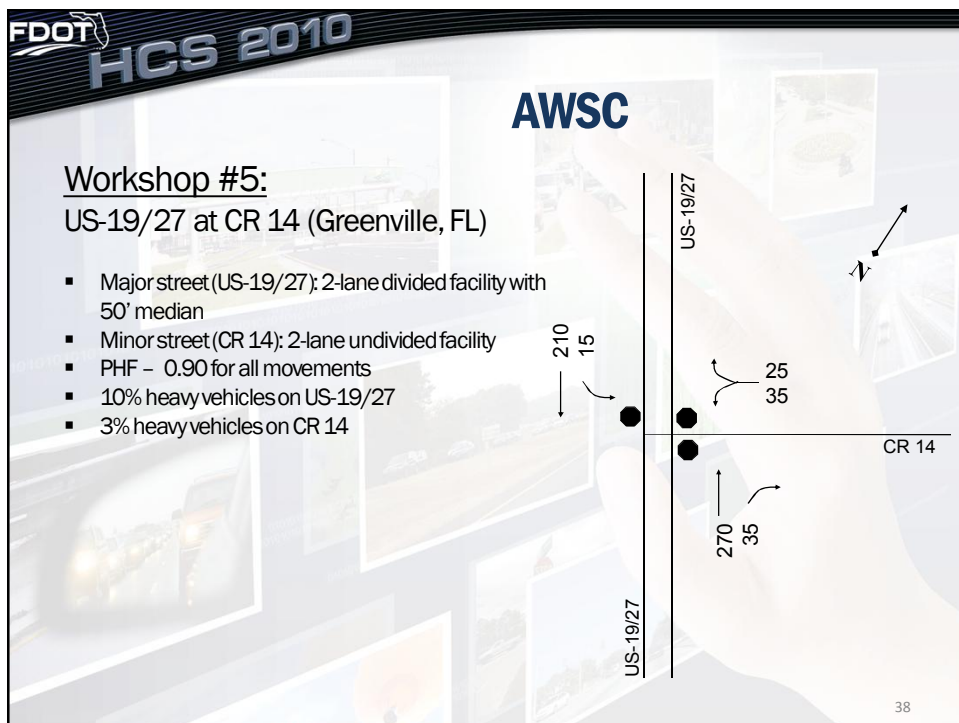
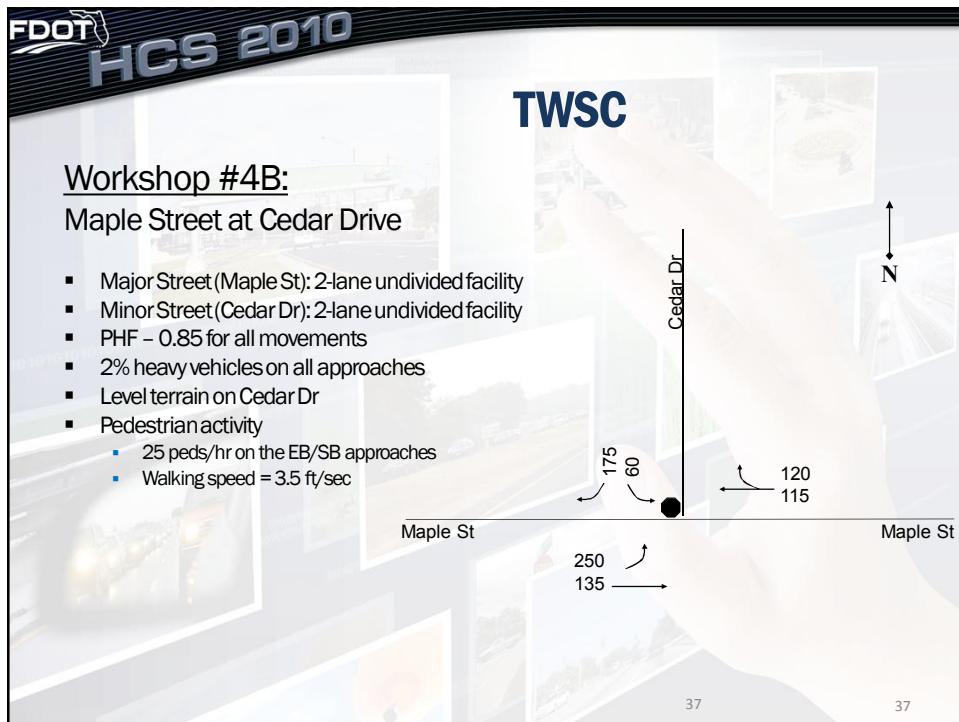
Workshop #4A:

Maple Street at Cedar Drive

- Maple St: 2-lane undivided facility
- Cedar Dr: 2-lane undivided facility
- PHF - 0.85 for all movements
- 2% heavy vehicles on all approaches
- Level terrain
- Pedestrian activity
 - 25 peds/hr on the EB/SB approaches



36



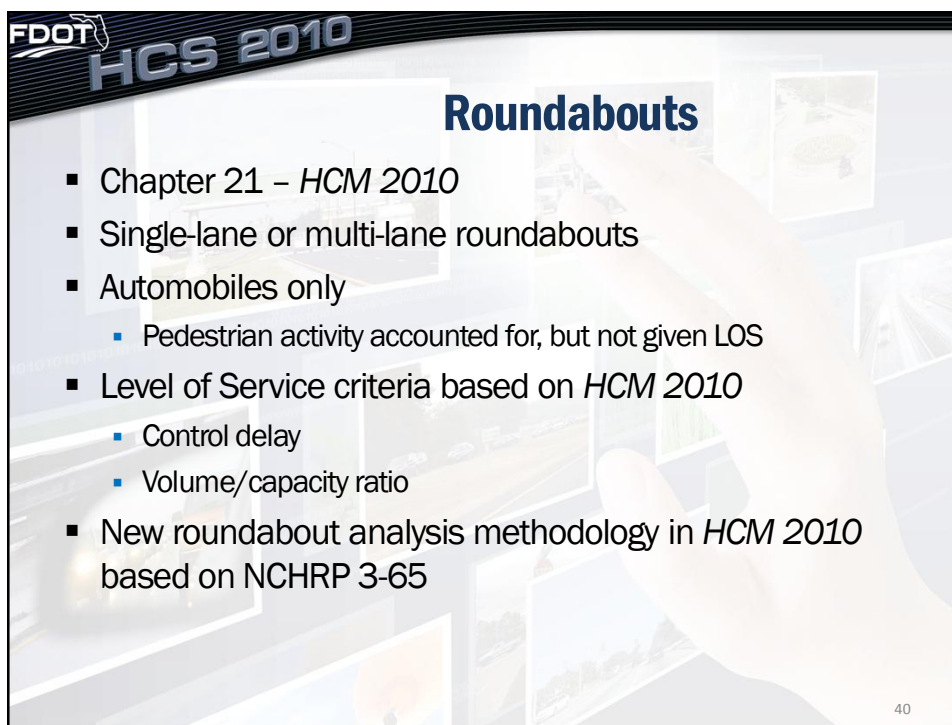


FDOT
HCS 2010

Day 1 – Interrupted Flow

- Overview
- Unsignalized Intersections
 - Two-Way Stop Control
 - All-Way Stop Control
- Roundabouts ◀

39



FDOT
HCS 2010

Roundabouts

- Chapter 21 – *HCM 2010*
- Single-lane or multi-lane roundabouts
- Automobiles only
 - Pedestrian activity accounted for, but not given LOS
- Level of Service criteria based on *HCM 2010*
 - Control delay
 - Volume/capacity ratio
- New roundabout analysis methodology in *HCM 2010* based on NCHRP 3-65

40

FDOT HCS 2010

Roundabouts

- HCM 2010 Exhibit 21-9

```

graph TD
    Step1[Step 1: Convert movement demand volumes to flow rates] --> Step2[Step 2: Adjust flow rates for heavy vehicles]
    Step2 --> Step3[Step 3: Determine circulating and exiting flow rates]
    Step3 --> Step4[Step 4: Determine entry flow rates by lane]
    Step4 --> Step5[Step 5: Determine the capacity of each entry lane and bypass lane as appropriate in passenger car equivalents]
    Step5 --> Step6[Step 6: Determine pedestrian impedance to vehicles]
    Step6 --> Step7[Step 7: Convert lane flow rates and capacities into vehicles per hour]
    Step7 --> Step8[Step 8: Compute the volume-to-capacity ratio for each lane]
    Step8 --> Step9[Step 9: Compute the average control delay for each lane]
    Step9 --> Step10[Step 10: Determine LOS for each lane on each approach]
    Step10 --> Step11[Step 11: Compute the average control delay and determine LOS for each approach and the roundabout as a whole]
    Step11 --> Step12[Step 12: Compute 95th percentile queues for each lane]
  
```

41

FDOT HCS 2010

Roundabouts

Required Data

- Traffic characteristics
 - Percentage of heavy vehicles
 - Peak hour turning movement volumes
 - Includes u-turn volumes
- Geometric configuration
 - Lane configurations
 - Right-turn bypass lanes

42

Roundabouts

Limitations

- The effects of upstream intersections
 - Upstream/downstream signalized intersections
 - Nearby roundabouts
- More than two entry lanes on an approach (HCM)
- High level of pedestrian/bicycle activity
- Methodology to determine pedestrian/bicycle LOS

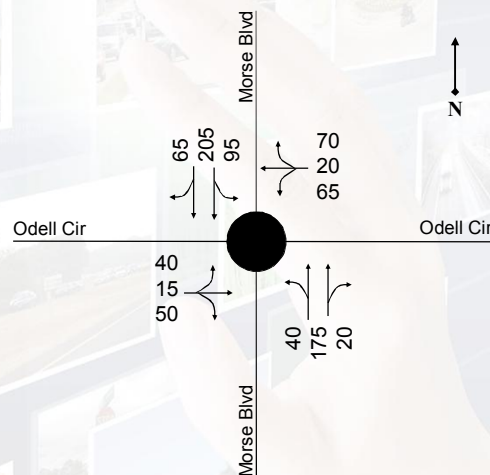
43

Roundabouts

Example #3:

Morse Boulevard at Odell Circle
(The Villages, FL)

- Morse Boulevard
 - 4-lane divided facility
- Odell Circle
 - 2-lane undivided facility
- 2 circulating lanes
- No right-turn bypass lane
- No pedestrians
- PHF = 0.96 for all approaches
- 3% heavy vehicles on all approaches



44

Roundabouts



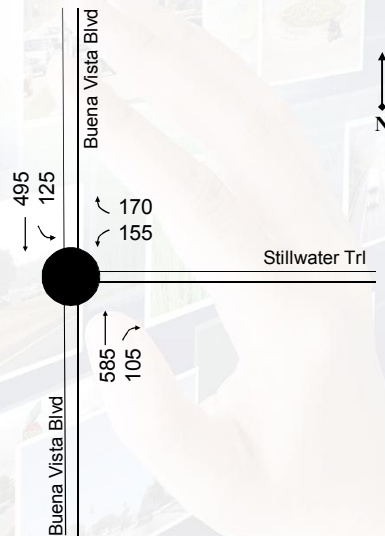
45

Roundabouts

Workshop #6:

Buena Vista Blvd at Stillwater Trl
(The Villages, FL)

- Buena Vista Blvd
 - 4-lane divided facility with 16' median
- Stillwater Trl
 - 4-lane divided facility with 16' median
- 2 circulating lanes
- No right-turn bypass lanes
- No pedestrians
- PHF - 0.92 for all approaches
- 2% heavy vehicles on all movements



46

Roundabouts



47

Day 2 – Interrupted Flow

- Signalized Intersections ◀
- Urban Streets
 - Segments
 - Facilities

48

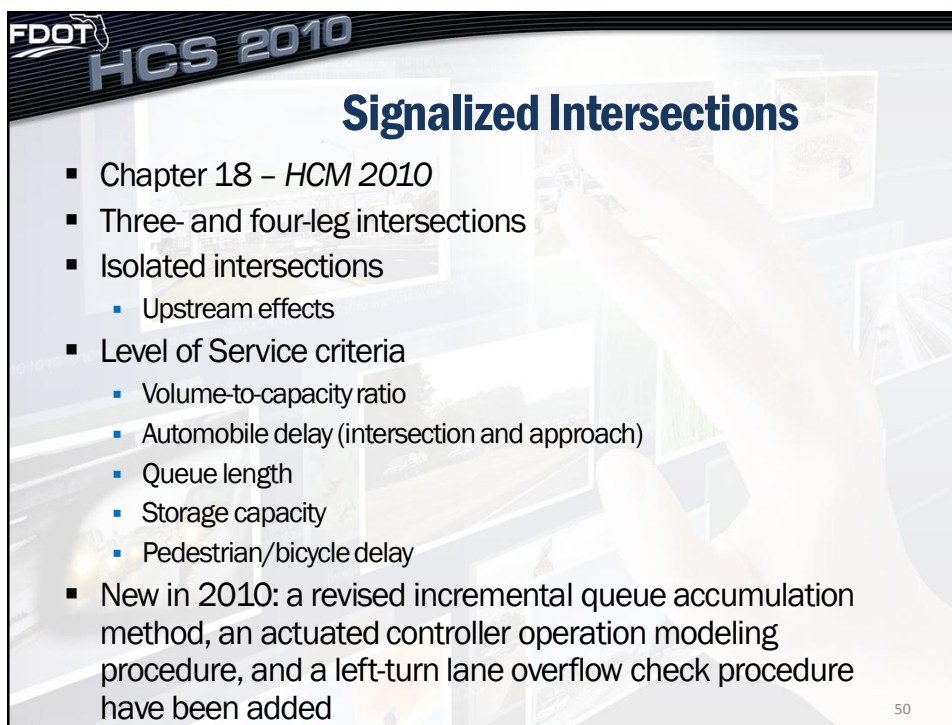


FDOT
HCS 2010

Housekeeping

- Breaks
 - 10:00 – 10:15 am
 - Lunch 11:30 – 1:00 pm
 - 2:30 – 2:45 pm

49



FDOT
HCS 2010

Signalized Intersections

- Chapter 18 – *HCM 2010*
- Three- and four-leg intersections
- Isolated intersections
 - Upstream effects
- Level of Service criteria
 - Volume-to-capacity ratio
 - Automobile delay (intersection and approach)
 - Queue length
 - Storage capacity
 - Pedestrian/bicycle delay
- New in 2010: a revised incremental queue accumulation method, an actuated controller operation modeling procedure, and a left-turn lane overflow check procedure have been added

50

Signalized Intersections

- HCM 2010 Exhibit 18-4 (LOS for Automobiles)

Control Delay (s/veh)	LOS by Volume-to-Capacity Ratio ^a	
	≤1.0	>1.0
≤10	A	F
>10–20	B	F
>20–35	C	F
>35–55	D	F
>55–80	E	F
>80	F	F

Note: ^a For approach-based and intersectionwide assessments, LOS is defined solely by control delay.

- HCM 2010 Exhibit 18-5 (LOS for Peds/Bicycles)

LOS	LOS Score
A	≤2.00
B	>2.00–2.75
C	>2.75–3.50
D	>3.50–4.25
E	>4.25–5.00
F	>5.00

51

Signalized Intersections

Required Data

- Lane configurations
- Percentage of heavy vehicles
- Peak hour turning movement volumes
- Peak hour factor or 15-minute traffic volumes
- Traffic signal phasing
- Traffic signal timing parameters

52

Signalized Intersections

Limitations

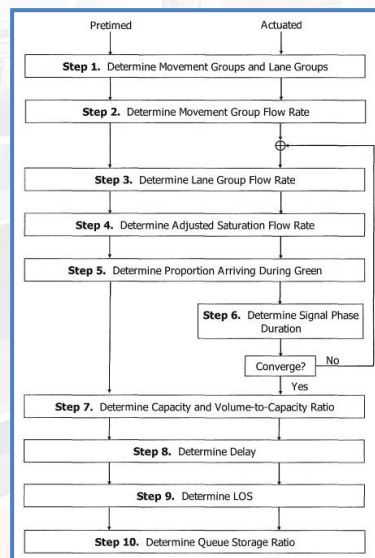
- Calibration
- Turn bay overflow
- Demand starvation
- Right turn on red (RTOR) volume
- Effects to/from upstream intersections
- Effects of add/drop lanes near intersection
- Controller functions (overlap, gap reduction)
- Pedestrian/bicycle (grades $>2\%$, railroad crossing)

53

Signalized Intersections

Methodology

- HCM 2010
Exhibit 18-11



54

Actuation

-

55

Terminology

-
- Diagram illustrating a 90-second cycle for a roundabout with two lanes in each direction. The cycle is divided into two 40-second halves by a 10-second gap.
- First 40-second half:**
- Left Lane: 15 s (Green Arrow) + 35 s (Green Arrow)
 - Right Lane: 20 s (Green Arrow) + 30 s (Green Arrow)
- Second 40-second half:**
- Left Lane: 15 s (Green Arrow) + 25 s (Green Arrow)
 - Right Lane: 10 s (Green Arrow) + 30 s (Green Arrow)
- The total cycle duration is 90 seconds.

56

Signalized Intersections

Terminology

- **Minimum green time:** Minimum amount of green time (in seconds) that a vehicle movement receives. Typically a set standard adopted by each agency.
 - Typically range from 4 to 15 seconds
- **Maximum green time:** Maximum amount of green time (in seconds) that a green signal indication can be displayed in the presence of conflicting demand.
 - Typical ranges:
 - 15 to 30 seconds (left turn phases)
 - 20 to 40 seconds (through phase for minor street approach)
 - 30 to 60 seconds (through phase for major street approach)

57

Signalized Intersections

Terminology

- **Vehicle clearance time:** Yellow time + all-red time
 - Yellow time is based on the approach speed & grade
 - All-red time is based on the approach speed & intersection width
- **Platoon:** Group of vehicles traveling together through a coordinated system

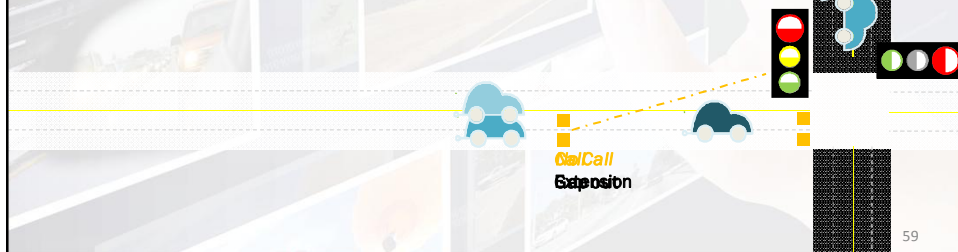
20 sVehicle Clearance Time

58

Signalized Intersections

Terminology

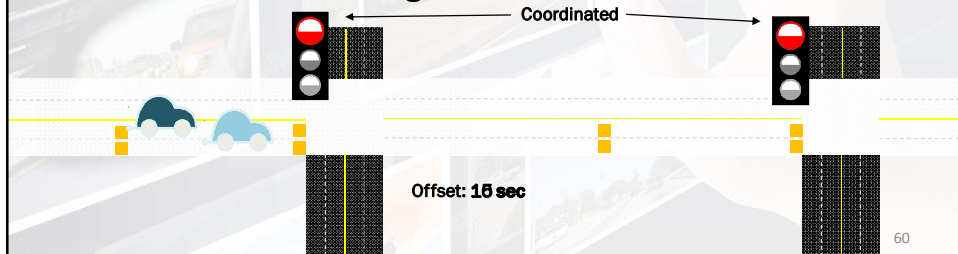
- **Extension:** The time (in seconds) an actuated phase is extended (past the minimum green time) due to vehicle calls
- **Gap out:** After the minimum green time is served on one phase, a signal serves the next phase early if a vehicle call is not placed on the current phase



Signalized Intersections

Terminology

- **Coordinated system:** A system of interconnected traffic signals that are timed to maximize flow along a major street
- **Offset:** The time delay (in seconds) between the start of a cycle at a "master" intersection in a coordinated system and another intersection—typically set so that the light turns green when you arrive at the next traffic signal



Signalized Intersections

Terminology

- **Recall:** Whether or not the controller will automatically place a call for a specified phase each time the controller is servicing a conflicting phase
 - **Off:** A phase will not automatically place a call; also called None
 - **Minimum recall:** A phase will automatically place a call and only allocate the minimum green time to the phase unless subsequent calls are placed
 - **Maximum recall:** A phase will place a call each time and the maximum green time or split will be allocated to the phase. All phases should be considered as maximum recall for pre-timed traffic signals
 - **Pedestrian recall:** The controller will place a continuous call for pedestrian service on the phase and then service the phase for at least an amount of time equal to its walk and pedestrian clear intervals (more if vehicle detections are received). Pedestrian recall is used for phases that have a high probability of pedestrian demand every cycle and no pedestrian detection.

61

Signalized Intersections

Terminology

- **Pedestrian timings:** Whether or not the controller will automatically place a call for a specified phase each time the controller is servicing a conflicting phase
 - **Walk interval:** The walk interval is intended to give pedestrians adequate time to perceive the WALK indication and depart the curb before the pedestrian change interval begins
 - **Pedestrian clearance:** A flashing DON'T WALK or countdown timer indication is displayed during this interval



Walk Interval: ■ sec

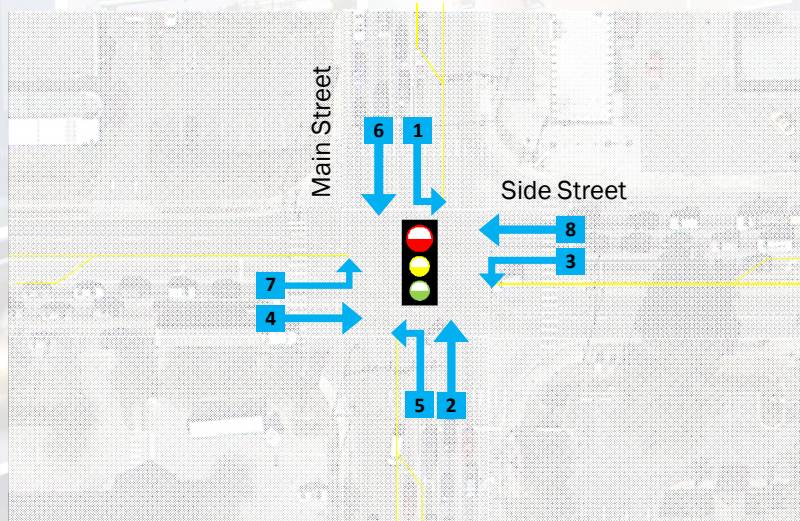
Pedestrian Clearance: ■ sec

DON'T
WALK

62

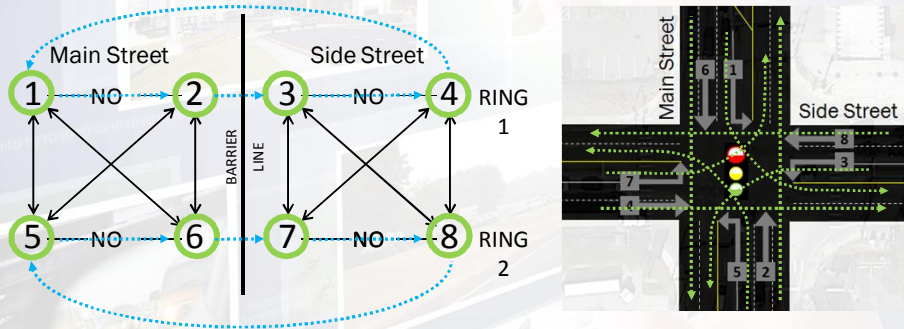
Signalized Intersections

National Electrical Manufacturers Association (NEMA) Phasing



63

Signalized Intersections



64

Signalized Intersections

Left-Turn Phasing

- **Protected turn:** A green arrow
- **Permissive turn:** A green ball (or flashing yellow arrow) where left turns have to yield to oncoming traffic
- **Protected + Permissive turn:** Starts as green arrow, changes to green ball (or vice versa)

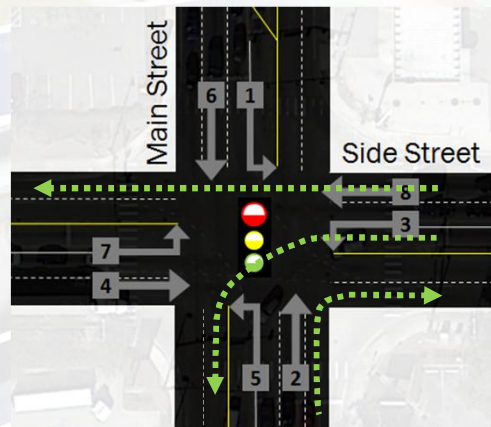


65

Signalized Intersections

Overlap Phasing

- Right-turn movements operating in exclusive lanes assigned to more than one phase that is not conflicting

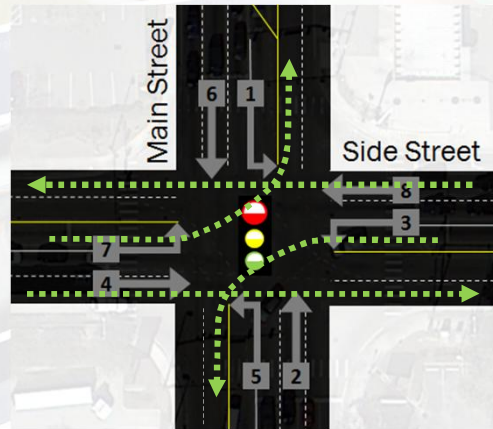


66

Signalized Intersections

Split Phasing

- Having two opposing approaches time consecutively rather than concurrently

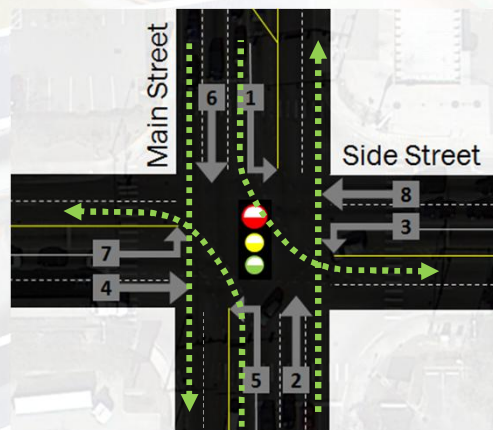


67

Signalized Intersections

Lead: Phasing in which left turn phase precedes opposing through phase

Lag: Phasing in which left turn phase follows opposing through phase



68

Signalized Intersections

Arrival Type

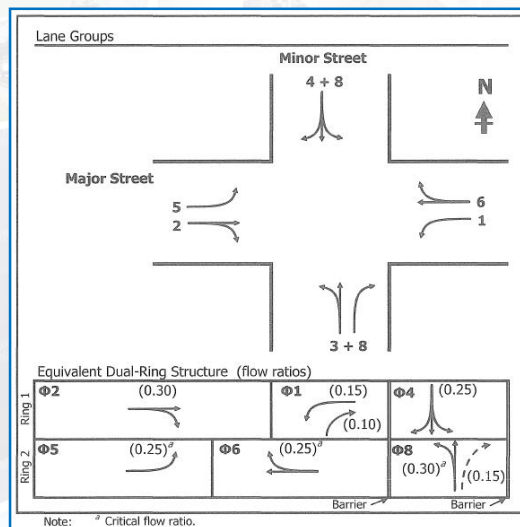
- Describes the quality of signal progression
- Values range from 1 to 6
 - Value of 1 represents poor progression
 - Value of 3 represents random arrivals
 - Value of 6 represents exceptional progression
- Typically, arrival type 3 used for uncoordinated movements and arrival type 4 used for most coordinated movements

69

Signalized Intersections

Critical Paths

- HCM 2010
Exhibit 18-15



70

FDOT HCS 2010

Signalized Intersections

- **HCM 2010 Exhibit 18-8**

Platoon Ratio	Arrival Type	Progression Quality
0.33	1	Very poor
0.67	2	Unfavorable
1.00	3	Random arrivals
1.33	4	Favorable
1.67	5	Highly favorable
2.00	6	Exceptionally favorable

- **HCM 2010 Exhibit 18-29**

Arrival Type	Progression Quality	Signal Spacing (ft)	Conditions Under Which Arrival Type Is Likely to Occur
1	Very poor	≤1,600	Coordinated operation on a two-way street where the subject direction does not receive good progression
2	Unfavorable	>1,600–3,200	A less extreme version of Arrival Type 1
3	Random arrivals	>3,200	Isolated signals or widely spaced coordinated signals
4	Favorable	>1,600–3,200	Coordinated operation on a two-way street where the subject direction receives good progression
5	Highly favorable	≤1,600	Coordinated operation on a two-way street where the subject direction receives good progression
6	Exceptional	≤800	Coordinated operation on a one-way street in dense networks and central business districts

71

FDOT HCS 2010

Signalized Intersections

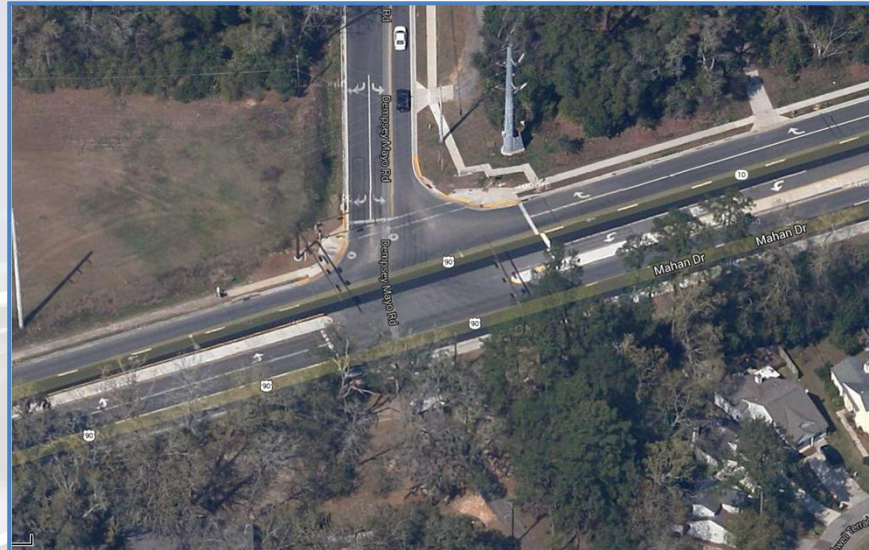
Example #4: Mahan Dr at Dempsey Mayo Rd (Tallahassee, FL)

- Forward direction – eastbound
- PHF – 0.95 for all movements
- 6% HV on major approaches
- 3% HV on minor approach
- Level terrain
- Arrival type 4 on mainline, 3 on side street
- 45 MPH speed limit on all approaches
- Cycle length – 80 seconds (actuated-coordinated)

Phase Approach	2 EBT	4 SBT	5 EBL	6 WBT
Phase Split	64.0	16.0	18.0	46.0
Yellow	4.4	4.0	3.0	4.3
Red	1.6	1.0	3.5	1.7
Min. Green	15.0	5.0	5.0	15.0
Recall	Min	Off	Off	Min

72

Signalized Intersections



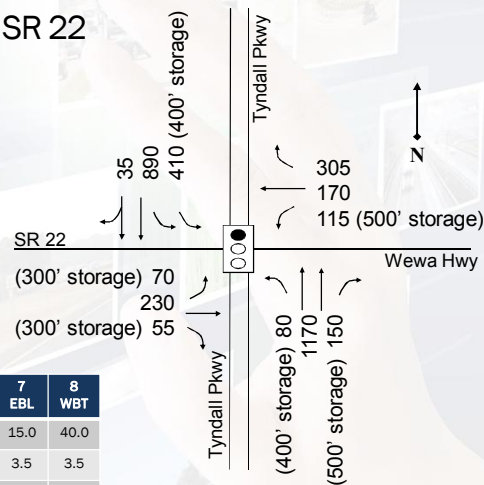
73

Signalized Intersections

Workshop #7: Tyndall Pkwy at SR 22 (Callaway, FL)

- Forward direction – northbound
- PHF – 0.90 for all movements
- Saturation – 1950 pc/h/ln
- 6% heavy vehicles for all movements
- Level terrain
- Arrival type 4 on mainline, 3 on side street
- 35 MPH speed limit on all approaches
- Cycle length – 160 seconds (coordinated)
- Protected RT at phases: 1, 3, 5
- E/W LT phases are protected + permitted
- Field-measured phase times are used

Phase Approach	1 SBL	2 NBT	3 WBL	4 EBT	5 NBL	6 SBT	7 EBL	8 WBT
Phase Split	30.0	75.0	15.0	40.0	30.0	75.0	15.0	40.0
Yellow	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Red	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Min. Green	8	15	8	15	8	15	8	15
Recall	Off	Max	Off	Off	Off	Max	Off	Off



74

Signalized Intersections



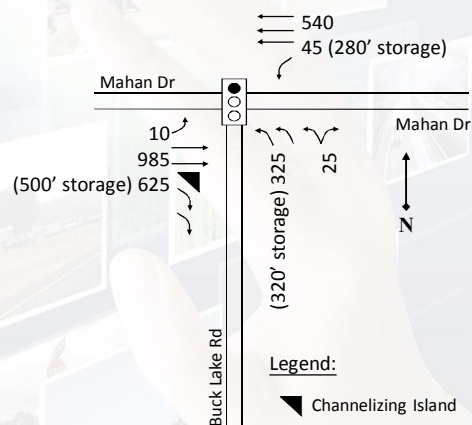
75

Signalized Intersections

Workshop #8: Mahan Dr at Buck Lake Rd (Tallahassee, FL)

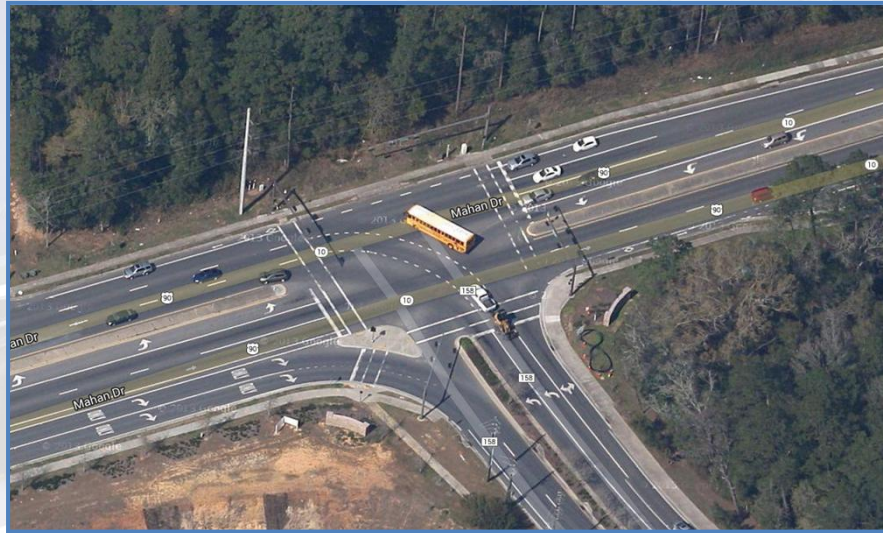
- Forward direction – eastbound
- PHF – 0.92 for all approaches
- 8% heavy vehicles on all movements
- Level terrain
- Arrival type 3
- 45 MPH speed limit on all approaches
- Cycle length – 160 seconds
- Field-measured phase times are used

Phase Approach	1 WBL	2 EBT	3 NBL	6 WBT
Split	18.0	100.0	42.0	118.0
Yellow	3.0	4.1	3.0	4.1
Red	3.3	1.9	4.0	1.9
Min. Green	4.0	18.0	7.0	18.0
Recall	Off	Max	Off	Off



76

Signalized Intersections



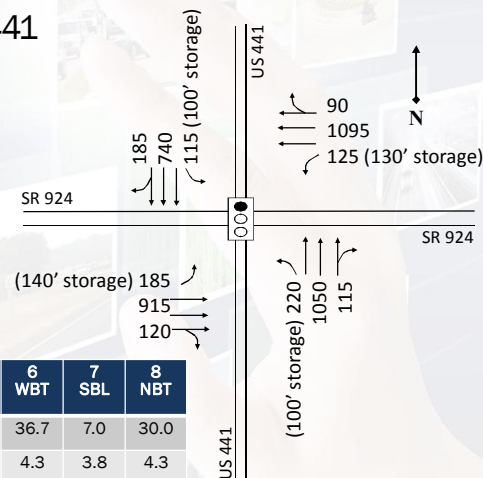
77

Signalized Intersections

Workshop #9: SR 924 at US 441 (Miami, FL)

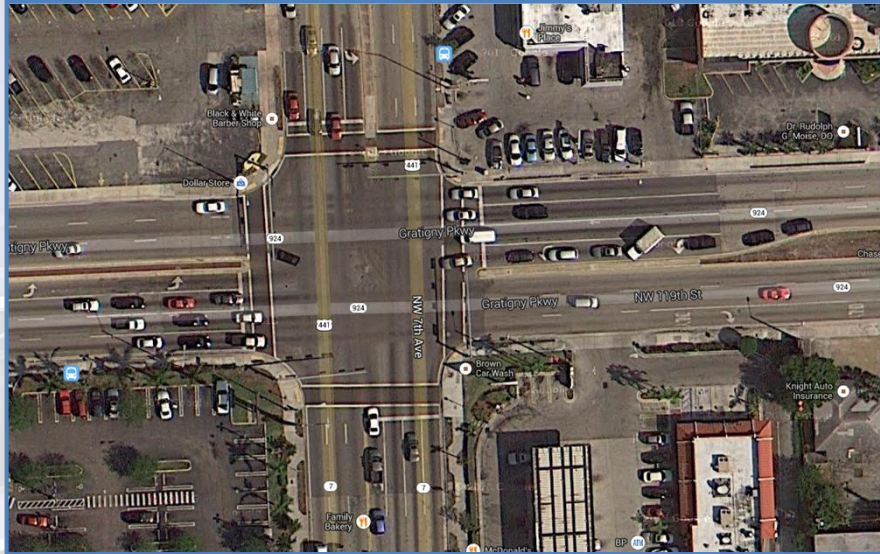
- Forward direction – eastbound
- PHF – 0.96 for all approaches
- 3% heavy vehicles on all movements
- Level terrain
- Arrival type 3
- 40 MPH speed limit on all approaches
- Cycle length – 100 seconds (pre-timed)
- Uncoordinated intersection
- Protected + permissive for all lefts

Phase Approach	1 WBL	2 EBT	3 NBL	4 SBT	5 EBL	6 WBT	7 SBL	8 NBT
Max. Green	7.0	36.7	7.0	30.0	7.0	36.7	7.0	30.0
Yellow	4.2	4.3	3.8	4.3	4.2	4.3	3.8	4.3
Red	0.0	1.3	0.0	1.4	0.0	1.3	0.0	1.4
Min. Green	5.0	7.0	5.0	7.0	5.0	7.0	5.0	7.0



78

Signalized Intersections



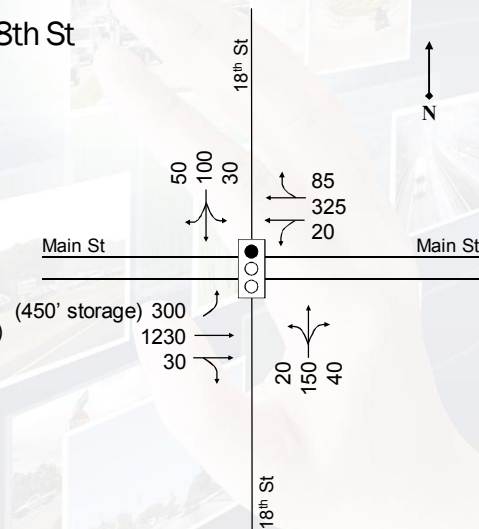
79

Signalized Intersections

Workshop #10: Main St at 18th St

- Forward direction – eastbound
- PHF – 0.90 for all movements
- 2% heavy vehicles for all movements
- Level terrain
- Arrival type 3
- 25 MPH speed limit for all approaches
- Cycle – 120 sec (pre-timed)
- 7 sec walk-time, 11-sec ped clearance
- 40 peds/hr crossing all approaches
- Split phasing on 18th St (NB is lag phase)
- Uncoordinated intersection
- Field-measured phase times are used

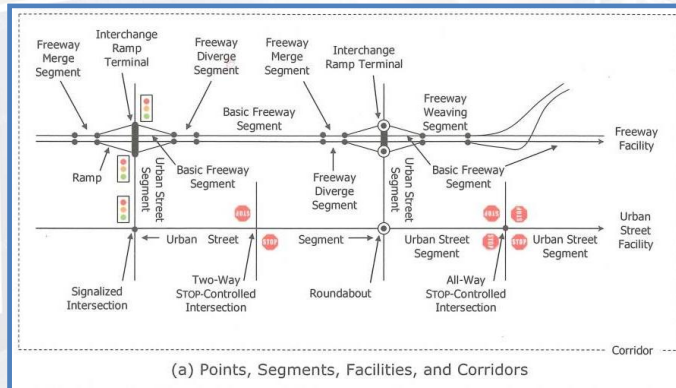
Phase Approach	2 EBT	5 EBL	6 WBT	8 NBT/SBT
Max. Green	54.5	18.5	30.5	24.5
Yellow	3.5	3.5	3.5	3.5
Red	2.0	2.0	2.0	2.0
Min. Green	4	4	4	4



80

Day 2 – Interrupted Flow

- Signalized Intersections
- Urban Streets
 - Segments ◀
 - Facilities



81

Urban Streets - Segments

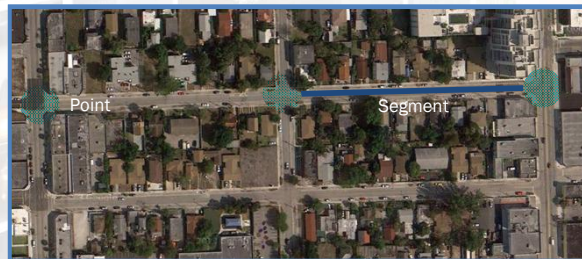
- Chapter 17 – *HCM 2010*
- New methodology for *HCM 2010* (based on NCHRP 3-79)
- Multimodal
 - Automobile, pedestrian, bicycle, and transit
- One-way and two-way arterials/collectors
- Intersections on segment end points
 - Signalized and unsignalized
- Multiple Level of Service criteria
 - Automobiles (travel speed and volume/capacity)
 - Pedestrians (LOS score and space value)
 - Bicycle/Transit (LOS score)

82

Urban Streets - Segments

Vocabulary

- **Point** – A boundary between links, usually a signalized intersection
- **Segment** – A portion of roadway extending from one point to another



83

Urban Streets - Segments

HCM 2010 Exhibit 17-2 (LOS for Automobiles)

Travel Speed as a Percentage of Base Free-Flow Speed (%)	LOS by Volume-to-Capacity Ratio ^a	
	≤ 1.0	> 1.0
>85	A	F
>67-85	B	F
>50-67	C	F
>40-50	D	F
>30-40	E	F
≤30	F	F

Note: ^aVolume-to-capacity ratio of through movement at downstream boundary intersection.

HCM 2010 Exhibit 17-3 (LOS for Pedestrians)

Pedestrian LOS Score	LOS by Average Pedestrian Space (ft ² /p)				
	>60	>40-60	>24-40	>15-24	>8.0-15 ^a
≤2.00	A	B	C	D	E
>2.00-2.75	B	B	C	D	E
>2.75-3.50	C	C	C	D	E
>3.50-4.25	D	D	D	D	E
>4.25-5.00	E	E	E	E	F
>5.00	F	F	F	F	F

Note: ^aIn cross-flow situations, the LOS E/F threshold is 13 ft²/p.

HCM 2010 Exhibit 17-4 (LOS Bicycle and Transit)

LOS	LOS Score
A	≤2.00
B	>2.00-2.75
C	>2.75-3.50
D	>3.50-4.25
E	>4.25-5.00
F	>5.00

84

Urban Streets - Segments

Required Data

- Mid-segment and access point flow rates
- Lane configurations
- Number of access points
- Segment length
- Boundary intersection information
 - Signalized intersection information
 - Unsignalized intersection information
- Mid-segment intersection information
 - Unsignalized intersection information

85

Urban Streets - Segments

Required Data

- Unsignalized boundary intersection
 - Lane configurations
 - Percentage of heavy vehicles
 - Peak hour turning movement volumes
 - Peak hour factors
 - Special factors (channelization, median storage, grades, and upstream signals)

86

Urban Streets - Segments

Required Data

- Signalized boundary intersection
 - Lane configurations
 - Percentage of heavy vehicles
 - Peak hour turning movement volumes
 - Peak hour factor or 15-minute traffic volumes
 - Traffic signal phasing
 - Traffic signal timing parameters

87

Urban Streets - Segments

Required Data (non-automobile)

- Pedestrian
 - Pedestrian flow rate
 - Sidewalk information
 - Distance to nearest signal-controlled crossing
- Bicycle
 - On-street parking occupied
 - Lane configurations
 - Pavement condition rating
- Transit
 - Dwell time, transit frequency
 - Area type (CBD)
 - Transit stop information

88

Urban Streets - Segments

Limitations

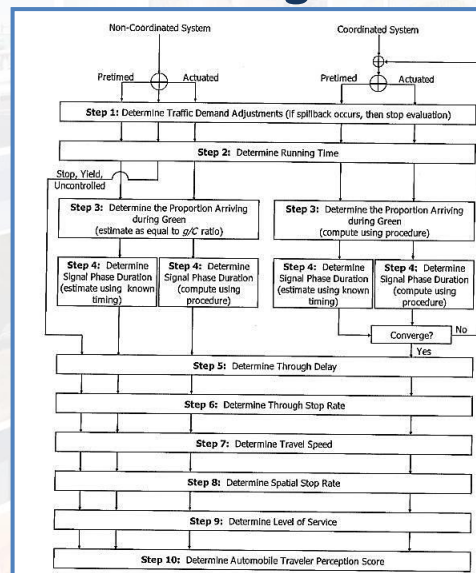
- Automobile
 - On-street parking activity
 - Capacity constraints between intersections
 - Queuing at the downstream boundary intersection
 - Shared-use lanes (Automobile/Bicycle)
- Non-automobile
 - Segments bound by All-Way Stop/Roundabouts
 - Mid-segment unsignalized crosswalks
 - Points of high volume pedestrian access to a sidewalk
 - Points where a high volume of vehicles cross a sidewalk

89

Urban Streets - Segments

Methodology

- Automobile Mode
(Exhibit 17-8)

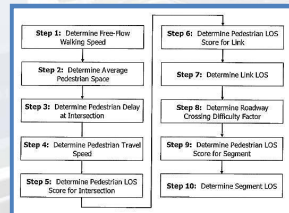


90

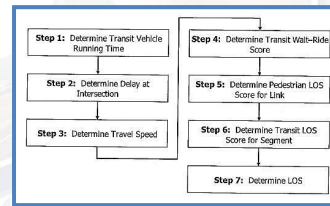
Urban Streets - Segments

Methodology

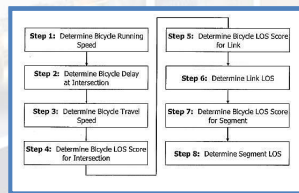
■ Pedestrian Mode (Exhibit 17-15)



■ Transit Mode (Exhibit 17-22)



■ Bicycle Mode (Exhibit 17-20)

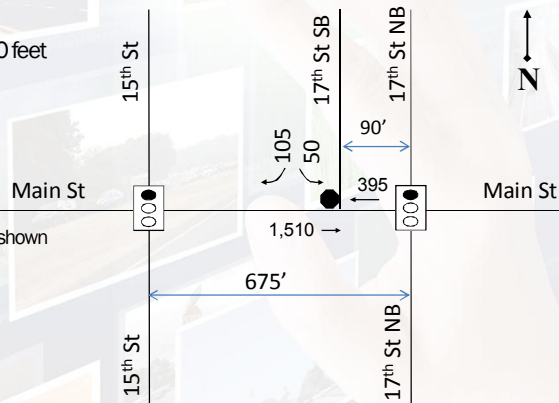


91

Urban Streets - Segments

Example #5: Main St between 15th St and 17th St NB

- Forward direction – eastbound
- 4-lane undivided roadway
- 25 MPH speed limit
- Upstream width EB/WB – 60 feet
- Segment default values
 - Cycle length: 120 sec
 - Minimum green: 4 sec
 - Yellow change: 3.5 sec
 - Red clearance: 2 sec
- Access Point
 - Volumes and geometry as shown
 - 17th Street southbound
 - PHF = 0.90



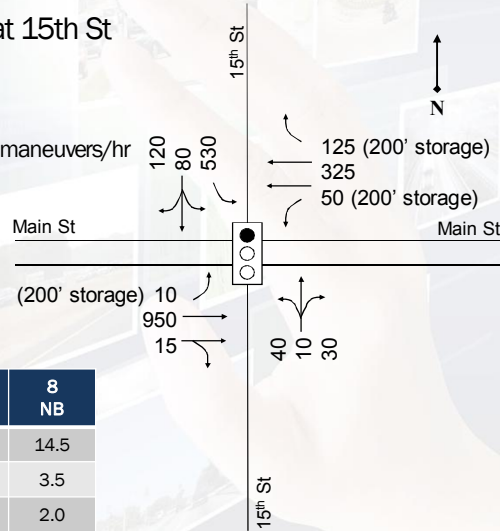
92

Urban Streets - Segments

Example #5 (cont): Main St at 15th St

- PHF - 0.90 for all movements
- 2% heavy vehicles for all movements
- EB and WB - 5 buses/hr
- On-street parking on WB approach - 10 maneuvers/hr
- 20 peds/hr crossing all approaches
- Arrival type 3
- Cycle length - 90 sec (pre-timed)
- Split phasing (NB lag)
- Uncoordinated intersection
- Field-measured phase times
- 7 sec walk-time, 11-sec ped clearance

Phase Approach	2 EB	4 SB	6 WB	8 NB
Max. Green	29.5	29.5	29.5	14.5
Yellow	3.5	3.5	3.5	3.5
Red	2.0	2.0	2.0	2.0
Min. Green	4	4	4	4



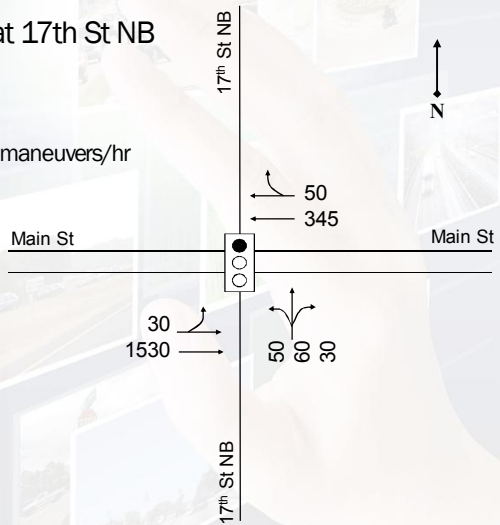
93

Urban Streets - Segments

Example #5 (cont): Main St at 17th St NB

- PHF - 0.90 for all movements
- 2% heavy vehicles for all movements
- EB and WB - 5 buses/hr
- On-street parking on WB approach - 10 maneuvers/hr
- 20 peds/hr crossing all approaches
- Arrival type 3
- Cycle length - 90 sec (pre-timed)
- Uncoordinated intersection
- Field-measured phase times
- 7 sec walk-time, 11-sec ped clearance

Phase Approach	2 EB	4 NB	6 WB
Max. Green	62.5	16.5	62.5
Yellow	3.5	3.5	3.5
Red	2.0	2.0	2.0
Min. Green	4	4	4



94

Urban Streets - Segments

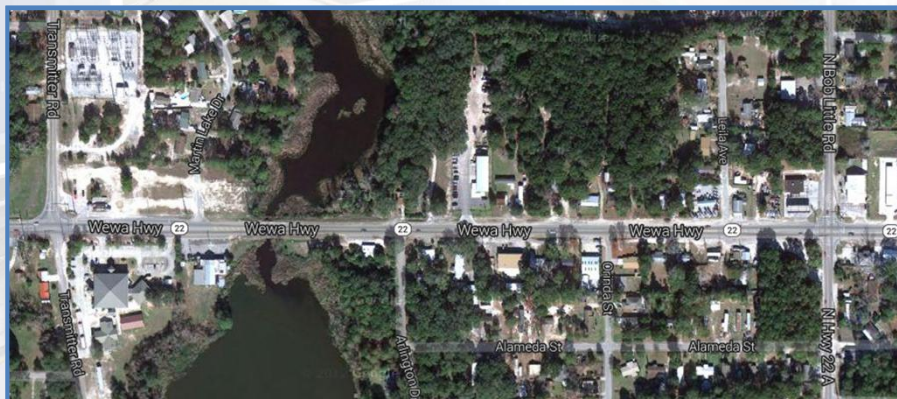
Workshop #11: SR 22 between Transmitter Rd and Bob Little Rd (Springfield, FL)

- Forward direction – eastbound
- 2-lane undivided mainline roadway
- 45 MPH speed limit
- Upstream width EB/WB – 40 feet
- Segment default values:
 - Cycle length: 60 sec
 - Minimum green: 2 sec
 - Yellow change: 3 sec
 - Red clearance: 1 sec
- Access Points
 - Volumes and geometry as shown
 - Assume turn lanes with 200' storage from SR 22
 - PHF = 0.90

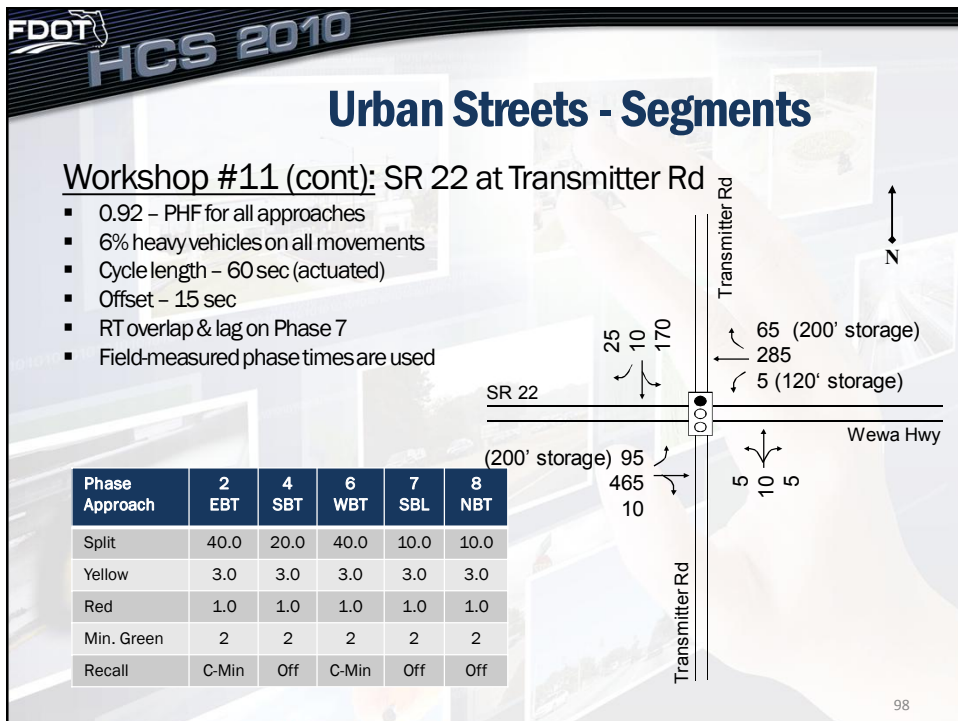
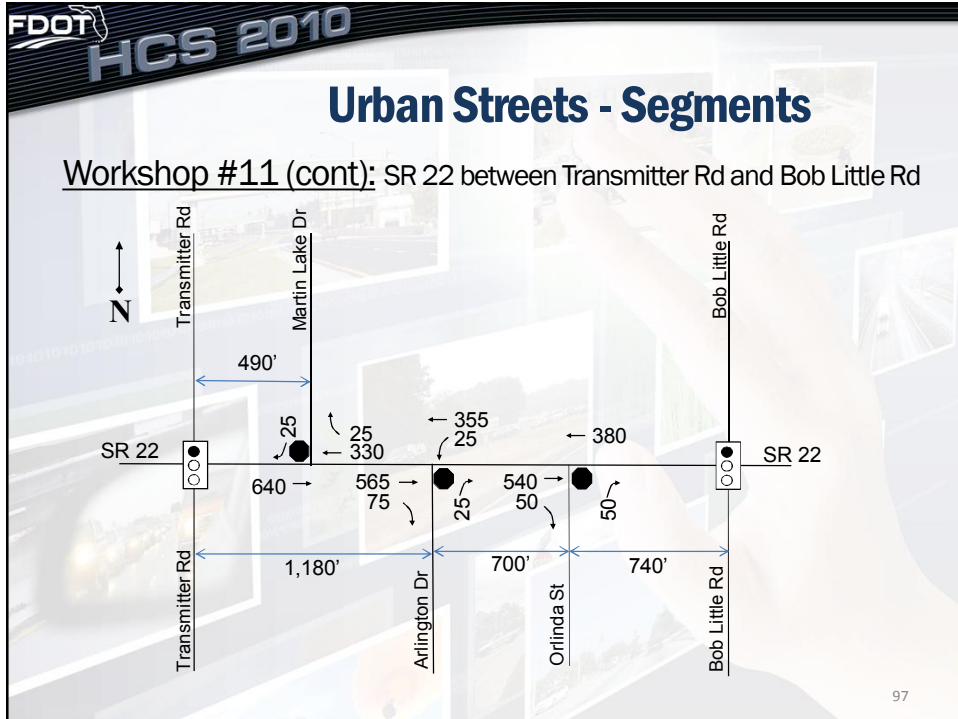
95

Urban Streets - Segments

Workshop #11: SR 22 between Transmitter Rd & Bob Little Rd (Springfield, FL)



96

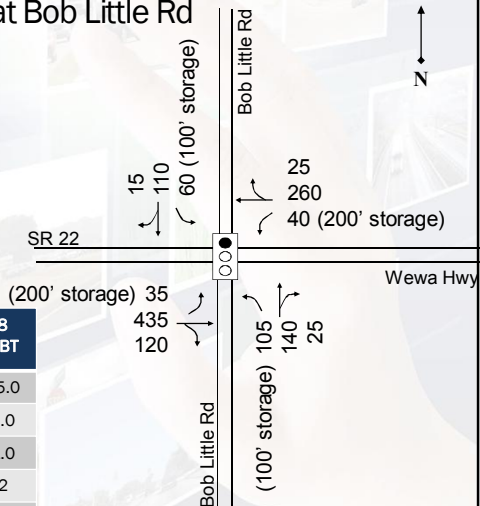


Urban Streets - Segments

Workshop #11 (cont): SR 22 at Bob Little Rd

- 0.92 - PHF for all approaches
- 6% heavy vehicles on all movements
- Cycle length - 60 sec (actuated)
- Offset - 35 sec
- Lag phase: Phase 3
- Field-measured phase times are used

Phase Approach	2 EBT	3 NBL	4 SBT	6 WBT	8 NBT
Split	35.0	15.0	10.0	35.0	25.0
Yellow	3.0	3.0	3.0	3.0	3.0
Red	1.0	1.0	1.0	1.0	1.0
Min. Green	2	2	2	2	2
Recall	C-Min	Off	Off	C-Min	Off



99

Day 2 - Interrupted Flow

- Signalized Intersections
- Urban Streets
 - Segments
 - Facilities

100

Urban Streets - Facilities

- Chapter 16 – HCM 2010
- New methodology for HCM 2010
- Multimodal
 - Automobile, pedestrian, bicycle, and transit
- One-way and two-way arterials/collectors
- Multiple level of service criteria
 - Travel speed (all modes)
 - Stop rate (automobile)
 - Perception score (pedestrian/bicycle/transit)
 - Pedestrian (space)

101

Urban Streets - Facilities

- Exhibit 16-4 HCM 2010 (LOS for Automobiles)

Travel Speed as a Percentage of Base Free- Flow Speed (%)	LOS by Critical Volume-to-Capacity Ratio ^a	
	≤ 1.0	> 1.0
>85	A	F
>67-85	B	F
>50-67	C	F
>40-50	D	F
>30-40	E	F
≤30	F	F

Note: ^a The critical volume-to-capacity ratio is based on consideration of the through movement volume-to-capacity ratio at each boundary intersection in the subject direction of travel. The critical volume-to-capacity ratio is the largest ratio of those considered.

- Exhibit 16-5 HCM 2010 (LOS for Pedestrians)

Pedestrian LOS Score	LOS by Average Pedestrian Space (ft ² /p)				
	>60	>40-60	>24-40	>15-24	>8.0-15 ^a
≤2.00	A	B	C	D	E
>2.00-2.75	B	B	C	D	E
>2.75-3.50	C	C	C	D	E
>3.50-4.25	D	D	D	D	E
>4.25-5.00	E	E	E	E	F
>5.00	F	F	F	F	F

Note: ^a In cross-flow situations, the LOS E-F threshold is 13 ft²/p.

- Exhibit 16-6 HCM 2010 (LOS for Bicycle and Transit)

LOS	LOS Score
A	≤2.00
B	>2.00-2.75
C	>2.75-3.50
D	>3.50-4.25
E	>4.25-5.00
F	>5.00

102

Urban Streets - Facilities

- Exhibit 16-7 HCM 2010 (Input Data Requirements)

Data Category	Location	Input Data Element	Basis
Geometric Design	Segment	Segment length	Segment
Other	Segment	Analysis period duration	Facility
Performance Measures	Boundary intersection	Volume-to-capacity ratio	Through-movement group
	Segment	Base free-flow speed	Segment
		Travel speed	Segment

Notes: Through-movement group = one value for the segment through movement at the downstream boundary intersection (inclusive of any turn movements in a shared lane).
 Segment = one value or condition for each segment and direction of travel on the facility.
 Facility = one value or condition for the facility.

103

Urban Streets - Facilities

Required Data

- Mid-segment and access point flow rates
- Lane configurations
- Number of access points
- Segment length
- Boundary intersection information
 - Signalized intersection information
 - Unsignalized intersection information
- Mid-segment intersection information
 - Unsignalized intersection information

104



FDOT
HCS 2010

Urban Streets - Facilities

Required Data

- Unsignalized boundary intersection
 - Lane configurations
 - Percentage of heavy vehicles
 - Peak hour turning movement volumes
 - Peak hour factors
 - Special factors (channelization, median storage, grades, upstream signals)

105



FDOT
HCS 2010

Urban Streets - Facilities

Required Data

- Signalized boundary intersection
 - Lane configurations
 - Percentage of heavy vehicles
 - Peak hour turning movement volumes
 - Peak hour factor or 15-minute traffic volumes
 - Traffic signal phasing
 - Traffic signal timing parameters

106

Urban Streets - Facilities

Required Data (non-automobile)

- **Pedestrian**
 - Pedestrian flow rate
 - Sidewalk information
 - Distance to nearest signal-controlled crossing
 - Legality of mid-segment pedestrian crossing
- **Bicycle**
 - On-street parking occupied
 - Lane configurations
 - Pavement condition rating
- **Transit**
 - Dwell time, transit frequency
 - Area type (CBD)
 - Transit stop information

107

Urban Streets - Facilities

- **Limitations consistent with:**
 - Unsignalized intersections
 - Signalized intersections
 - Interchange ramp terminals
 - Urban street segments
- **However:**
 - If spillback affects performance, the analyst should consider using an alternative analysis tool that is able to model the effect of spillback conditions

108

FDOT HCS 2010

Urban Streets - Facilities

- Methodology
- Automobile Mode (Exhibit 16-9)
- Pedestrian Mode (Exhibit 16-10)*
- Bicycle Mode (Exhibit 16-12)*
- Transit Mode (Exhibit 16-13) *

Step 1: Determine Base Free-Flow Speed

Step 2: Determine Travel Speed

Step 3: Determine Spatial Stop Rate

Step 4: Determine Automobile LOS

Step 1: Determine Pedestrian Space

Step 2: Determine Pedestrian Travel Speed

Step 3: Determine Pedestrian LOS Score

Step 4: Determine Pedestrian LOS

Step 1: Determine Bicycle Travel Speed

Step 2: Determine Bicycle LOS Score

Step 3: Determine Bicycle LOS

Step 1: Determine Transit Travel Speed

Step 2: Determine Transit LOS Score

Step 3: Determine Transit LOS

***Specific to one side of street**

109

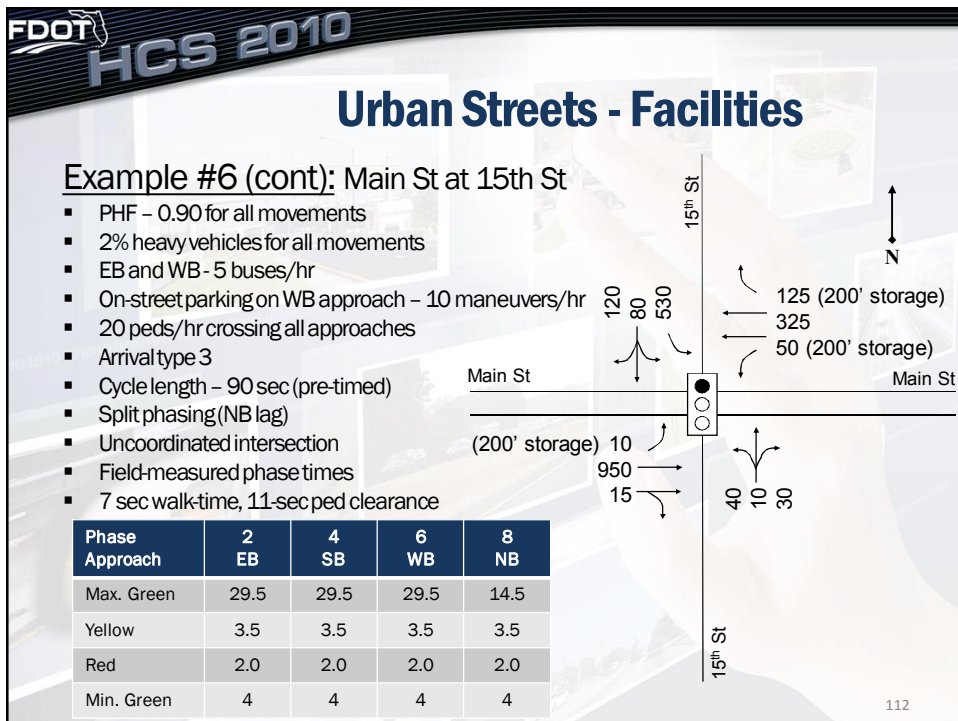
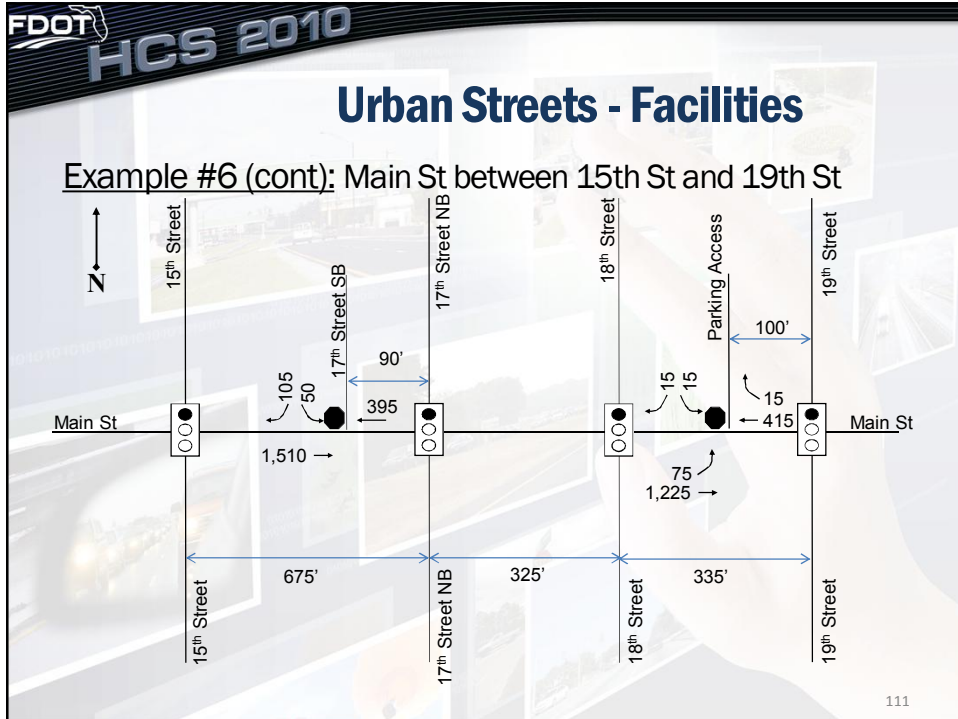
FDOT HCS 2010

Urban Streets - Facilities

Example #6: Main St between 15th St and 19th St

- Forward direction – eastbound
- 4-lane undivided roadway
- 25 MPH speed limit
- Upstream width EB/WB – 60 feet
- Segment default values
 - Cycle length: 90 sec
 - Minimum green: 4 sec
 - Yellow change: 3.5 sec
 - Red clearance: 2 sec
- Access Points
 - 17th St SB (585' east of 15th St)
 - Parking Access (235' east of 18th St)
 - PHF = 0.90
- Field-measured phase times

110

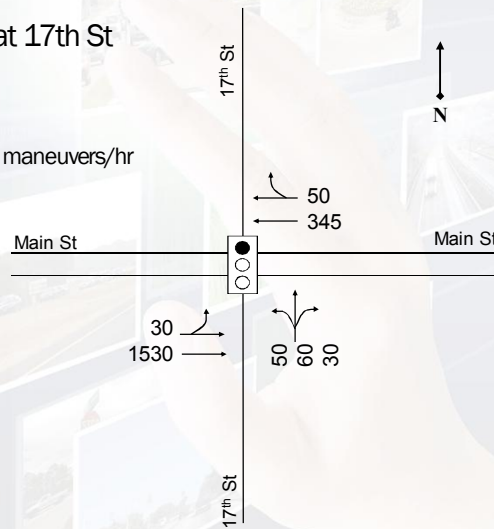


Urban Streets - Facilities

Example #6 (cont): Main St at 17th St

- PHF - 0.90 for all movements
- 2% heavy vehicles for all movements
- EB and WB - 5 buses/hr
- On-street parking on WB approach - 10 maneuvers/hr
- 20 peds/hr crossing all approaches
- Arrival type 3
- Cycle length - 90 sec (pre-timed)
- Uncoordinated intersection
- Field-measured phase times
- 7 sec walk-time, 11-sec ped clearance

Phase Approach	2 EB	4 NB	6 WB
Max. Green	62.5	16.5	62.5
Yellow	3.5	3.5	3.5
Red	2.0	2.0	2.0
Min. Green	4	4	4



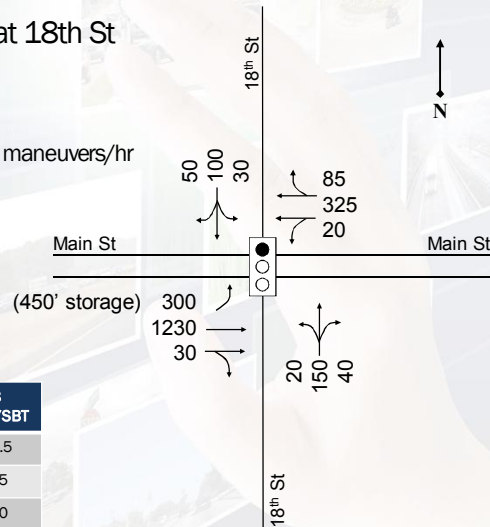
113

Urban Streets - Facilities

Example #6 (cont): Main St at 18th St

- PHF - 0.90 for all movements
- 2% heavy vehicles for all movements
- EB and WB - 5 buses/hr
- On-street parking on WB approach - 10 maneuvers/hr
- 40 peds/hr crossing all approaches
- Arrival type 3
- Cycle length - 120 sec (pre-timed)
- Split phasing (NB lag)
- Uncoordinated intersection
- Field-measured phase times
- 7 sec walk-time, 11-sec ped clearance

Phase Approach	2 EBT	5 EBL	6 WBT	8 NBT/SBT
Max. Green	54.5	18.5	30.5	24.5
Yellow	3.5	3.5	3.5	3.5
Red	2.0	2.0	2.0	2.0
Min. Green	4	4	4	4



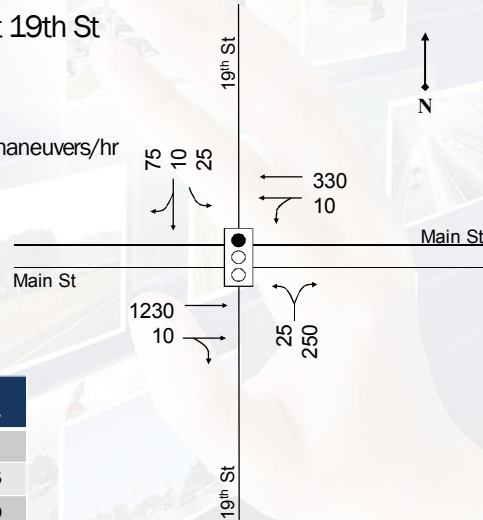
114

Urban Streets - Facilities

Example #6 (cont): Main St at 19th St

- PHF – 0.90 for all movements
- 2% heavy vehicles for all movements
- EB and WB – 5 buses/hr
- On-street parking on WB approach – 10 maneuvers/hr
- 10 peds/hr crossing all approaches
- Arrival type 3
- Cycle – 90 sec (pre-timed)
- Split phasing (SB lag)
- Uncoordinated intersection
- Field-measured phase times
- 7 sec walk-time, 11-sec ped clearance

Phase Approach	2 EB	4 SB	6 WB	8 NB
Max. Green	32	18	32	23
Yellow	3.5	3.5	3.5	3.5
Red	2.0	2.0	2.0	2.0
Min. Green	4	4	4	4



115

Urban Streets - Facilities

Workshop #12: SR 924 (Gratigny Pkwy) between 32nd Ave and 17th Ave (Miami, FL)

- 8-lane divided roadway with 30' median
- Upstream width EB/WB – 100 feet
- Cycle length = 100 sec for all intersections

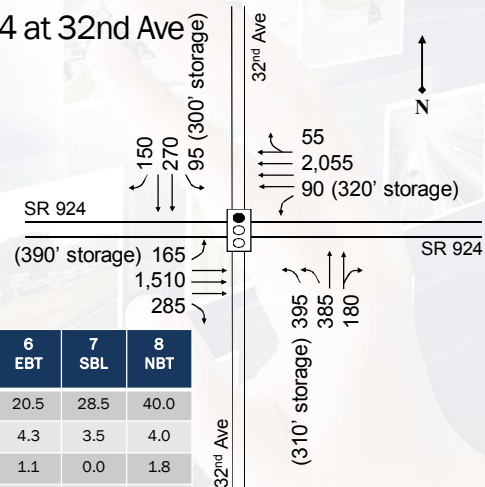


116

117

Workshop #12 (cont): SR 924 at 32nd Ave

- 0.92 – PHF for all approaches
- 5% HV on mainline approaches
- 14% HV on minor approaches
- 40 MPH speed limit on all approaches
- Cycle length – 100 sec (actuated)
- Offset – 28 sec
- EB, WB, & SB LT phases protected + permissive
 - NB LT phase protected only



Phase Approach	1 EBL	2 WBT	3 NBL	4 SBT	5 WBL	6 EBT	7 SBL	8 NBT
Split	11.0	20.5	28.5	40.0	11.0	20.5	28.5	40.0
Yellow	5.0	4.3	3.5	4.0	5.0	4.3	3.5	4.0
Red	0.0	1.1	0.0	1.8	0.0	1.1	0.0	1.8
Min. Green	5	5	5	7	5	5	5	7
Recall	Off	C-Min	Off	Off	Off	C-Min	Off	Off

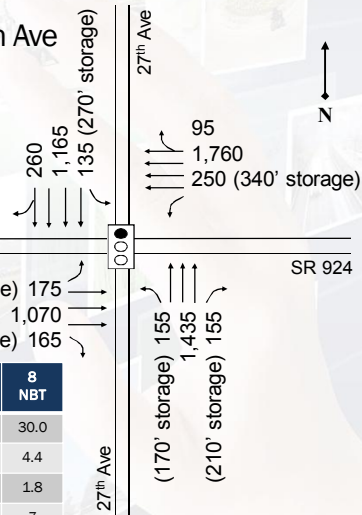
118

Urban Streets - Facilities

Workshop #12 (cont): SR 924 at 27th Ave

- 0.96 - PHF for all approaches
- 5% HV on mainline approaches
- 7% HV on minor approaches
- 40 MPH speed limit on mainline approaches
- 45 MPH speed limit on minor approaches
- Cycle length - 100 sec (actuated)
- Offset - 50 sec
- All LT phases are protected + permissive

Phase Approach	1 EBL	2 WBT	3 NBL	4 SBT	5 WBL	6 EBT	7 SBL	8 NBT
Split	15.8	38.8	15.4	30.0	15.8	38.8	15.4	30.0
Yellow	4.8	4.0	4.4	4.4	4.8	4.0	4.4	4.4
Red	0.0	1.8	0.0	1.8	0.0	1.8	0.0	1.8
Min. Green	5	5	5	7	5	5	5	7
Recall	Off	C-Min	Off	Off	Off	C-Min	Off	Off



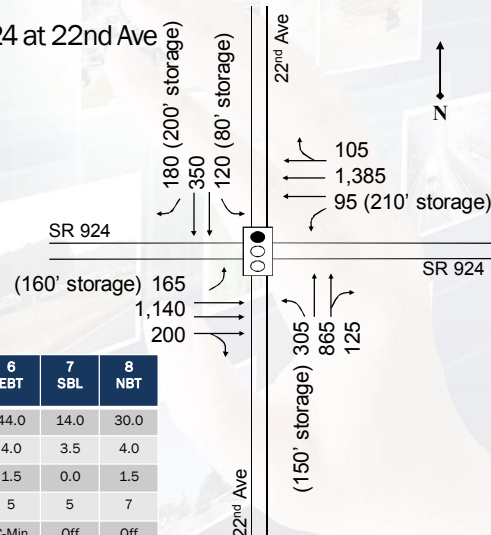
119

Urban Streets - Facilities

Workshop #12 (cont): SR 924 at 22nd Ave

- 0.93 - PHF for all approaches
- 3% HV on mainline approaches
- 2% HV on minor approaches
- 40 MPH speed limit on all approaches
- Cycle length - 100 sec (actuated)
- Offset - 99 sec
- N/S LT phases protected + permissive
 - E/W LT phases protected only

Phase Approach	1 EBL	2 WBT	3 NBL	4 SBT	5 WBL	6 EBT	7 SBL	8 NBT
Split	12.0	44.0	14.0	30.0	12.0	44.0	14.0	30.0
Yellow	3.5	4.0	3.5	4.0	3.5	4.0	3.5	4.0
Red	0.0	1.5	0.0	1.5	0.0	1.5	0.0	1.5
Min. Green	5	5	5	7	5	5	5	7
Recall	Off	C-Min	Off	Off	Off	C-Min	Off	Off

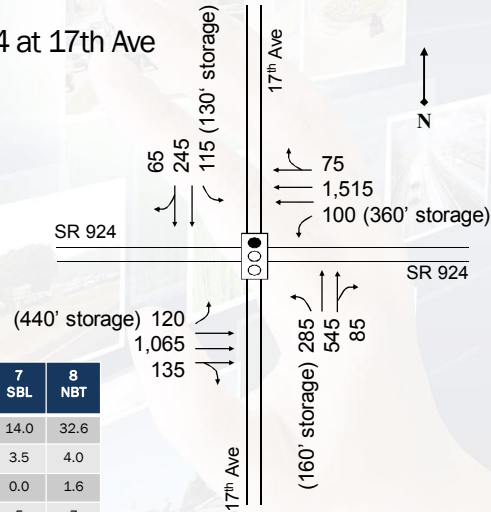


120

Urban Streets - Facilities

Workshop #12 (cont): SR 924 at 17th Ave

- 0.88 - PHF for all approaches
- 3% heavy vehicles on all movements
- 40 MPH speed limit on all approaches
- Cycle length - 100 sec (actuated)
- Offset - 68 sec
- All LT phases protected + permissive



Phase Approach	1 WBL	2 EBT	3 NBL	4 SBT	5 EBL	6 WBT	7 SBL	8 NBT
Split	11.0	42.4	14.0	32.6	11.0	42.4	14.0	32.6
Yellow	3.5	4.0	3.5	4.0	3.5	4.0	3.5	4.0
Red	0.0	1.1	0.0	1.6	0.0	1.1	0.0	1.6
Min. Green	5	5	5	7	5	5	5	7
Recall	Off	C-Min	Off	Off	Off	C-Min	Off	Off

121

Day 3 - Uninterrupted Flow (Mostly)

- Interchanges ◀
- Freeways
 - Basic segments
 - Weaving segments
 - Merge and diverge segments
 - Freeway facilities
- Multi-lane highway segments
- Two-lane highway segments

122

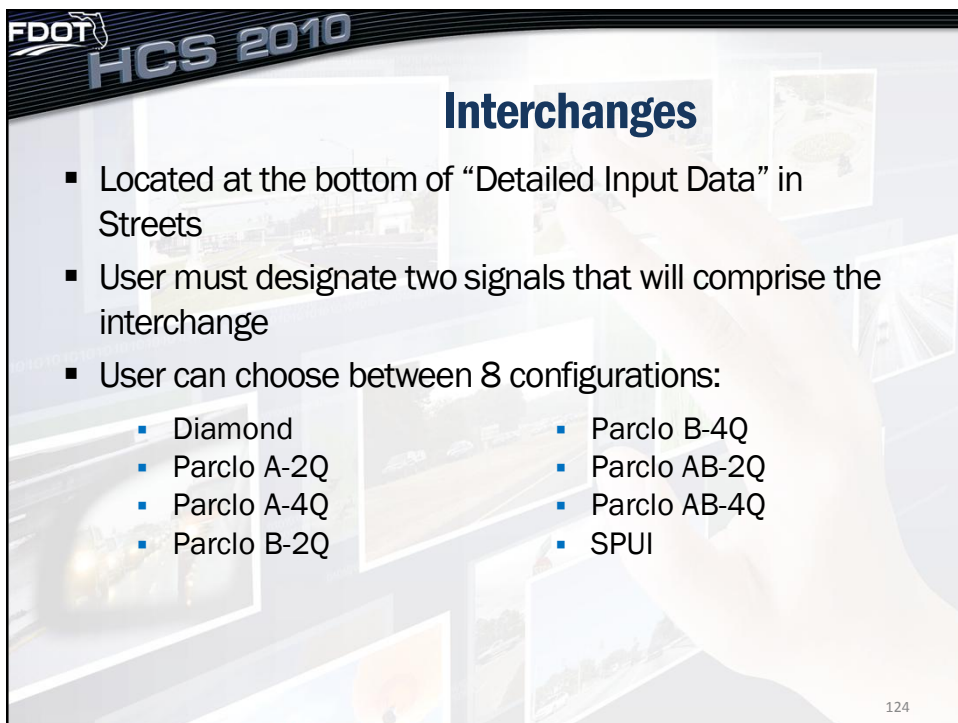


FDOT
HCS 2010

Housekeeping

- Breaks
 - 10:00 – 10:15 am
 - Lunch 11:30 – 1:00 pm
 - 2:30 – 2:45 pm

123



FDOT
HCS 2010

Interchanges

- Located at the bottom of “Detailed Input Data” in Streets
- User must designate two signals that will comprise the interchange
- User can choose between 8 configurations:
 - Diamond
 - Parclo A-2Q
 - Parclo A-4Q
 - Parclo B-2Q
 - Parclo B-4Q
 - Parclo AB-2Q
 - Parclo AB-4Q
 - SPUI

124

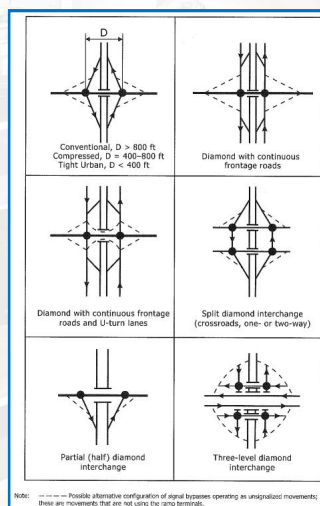
Interchanges

- “Parclo” is short for Partial Cloverleaf configuration
- Letters A, B, or AB refer to relative quadrant locations of ramps
- Numbers 2 or 4 refer to number of Quadrants
- “SPUI” is an acronym for Single-Point Urban Interchange; operates with only one intersection

125

Interchanges

- HCM 2010
Exhibit 22-1

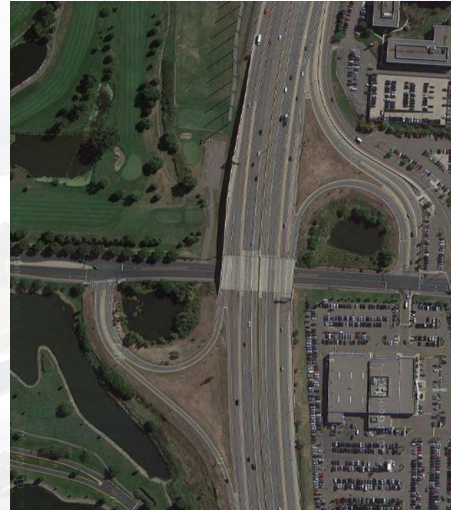
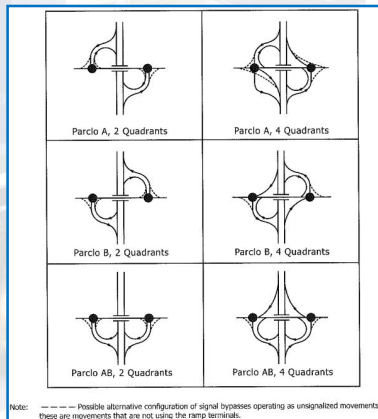


126

Interchanges

Configuration types

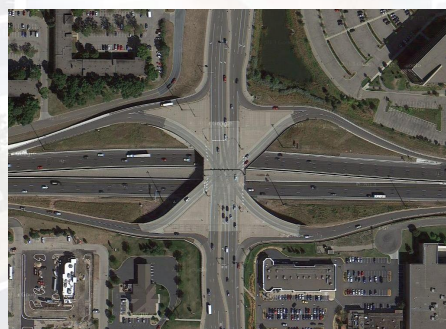
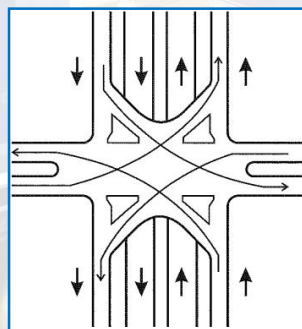
- HCM 2010 Exhibit 22-2



127

Interchanges

- HCM 2010 Exhibit 22-3



Single-Point Urban Interchange

128

Interchanges

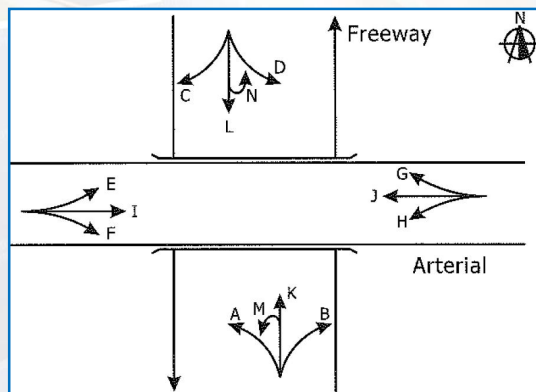


Single-Point Urban Interchange

129

Interchanges

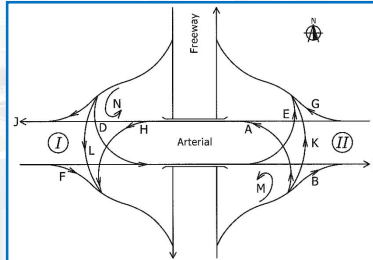
- Every possible Origin-Destination (O-D) movement within a configuration is assigned a letter A – N
- *HCM 2010*
Exhibit 22-5



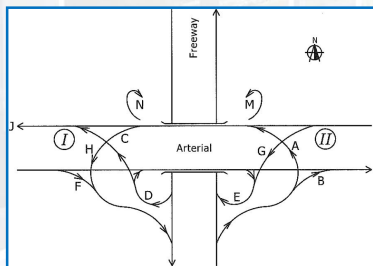
130

Interchanges

- HCM 2010
Exhibit 22-6



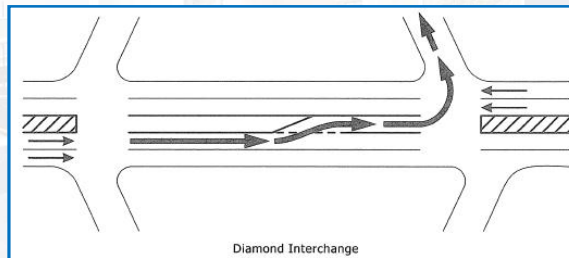
- HCM 2010
Exhibit 22-7



131

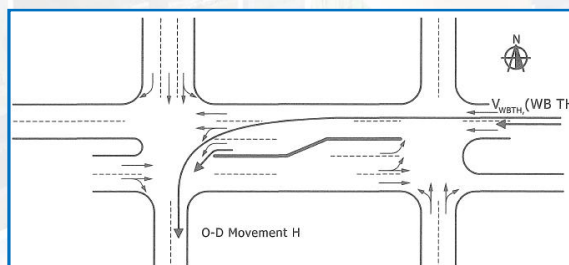
Interchanges

- HCM 2010
Exhibit 22-8



Diamond Interchange

- HCM 2010
Exhibit 22-10



O-D Movement H

132

Interchanges

- Each movement has a unique Demand (veh/h), Delay (s/veh) and corresponding LOS

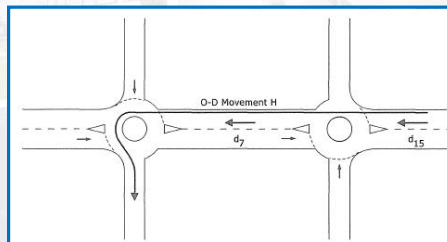
HCM 2010 Exhibit 22-11

Control Delay (s/veh)	O-D LOS		
	$v/c < 1$ and $R_Q < 1$ for Every Lane Group	$v/c > 1$ for Any Lane Group	$R_Q > 1$ for Any Lane Group
≤ 15	A	F	F
$>15-30$	B	F	F
$>30-55$	C	F	F
$>55-85$	D	F	F
$>85-120$	E	F	F
>120	F	F	F

133

Interchanges

- HCM 2010 Exhibit 22-12 - Interchanges with Roundabouts



- HCM 2010 Exhibit 22-13 - Interchanges with Roundabouts

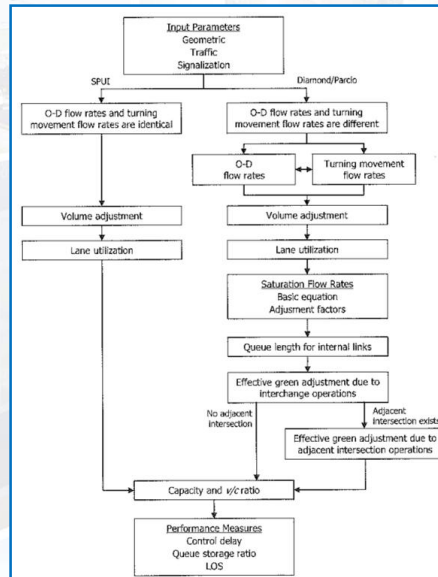
Control Delay (s/veh)	O-D LOS		
	$v/c < 1$ and $R_Q < 1$ for All Approaches	$v/c > 1$ for Any Approach	$R_Q > 1$ for Any Approach
≤ 15	A	F	F
$>15-25$	B	F	F
$>25-35$	C	F	F
$>35-50$	D	F	F
$>50-75$	E	F	F
>75	F	F	F

134

Interchanges

Methodology

- HCM 2010
Exhibit 22-14



137

Day 3 – Uninterrupted Flow (Mostly)

- Interchanges
- Freeways
 - Basic segments
 - Weaving segments
 - Merge and diverge segments
 - Freeway facilities
- Multi-lane highway segments
- Two-lane highway segments

138

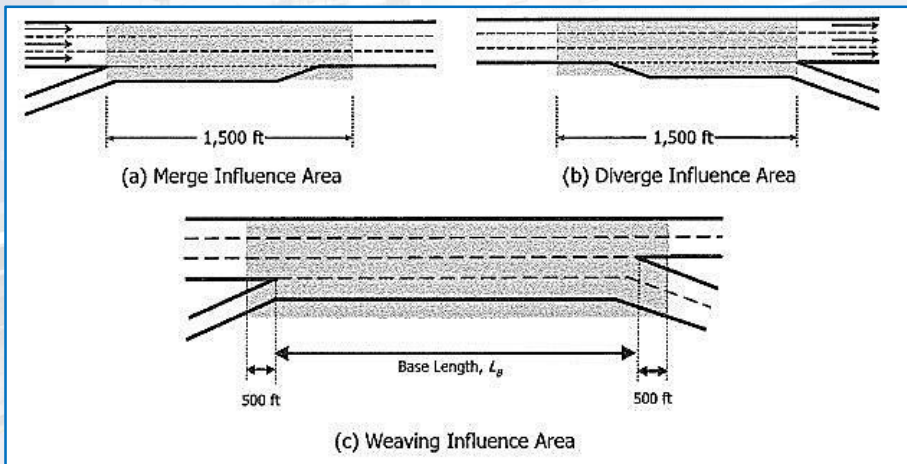
Basic Freeway Segments

- Chapter 11 – HCM 2010
- Freeway segments without influence from
 - Merging (1,500 feet downstream)
 - Diverging (1,500 feet upstream)
 - Weaving (500 feet upstream/downstream)
- Uniform segments under base conditions
 - Good weather/visibility
 - No incidents/work zone activity/pavement deterioration
- Level-of-service criteria
 - Density (passenger cars/mile/lane)
- New in 2010: New speed-flow curve for 75 mph

139

Basic Freeway Segments

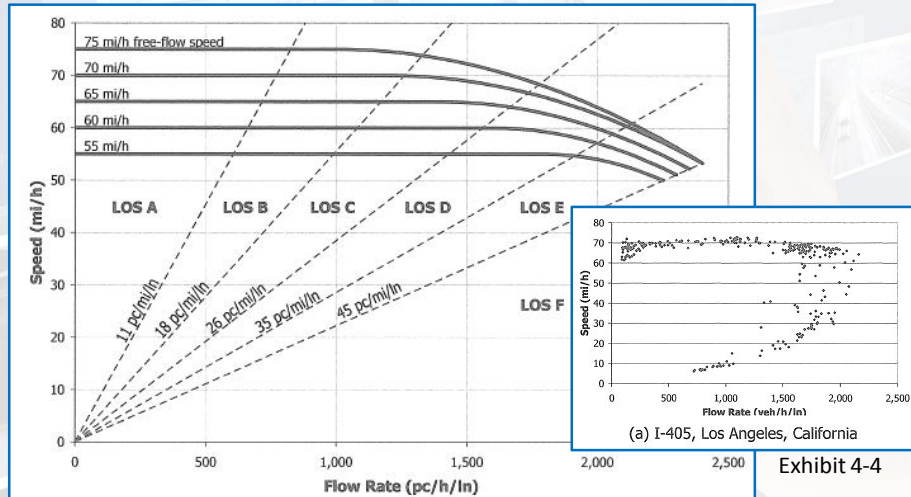
- HCM 2010 Exhibit 10-1



140

Basic Freeway Segments

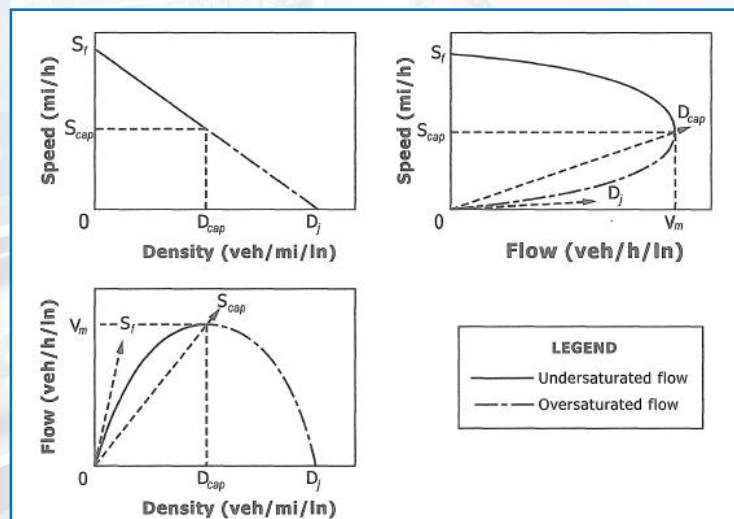
- HCM 2010 Exhibit 11-6



141

Speed, Flow, Density Relationships

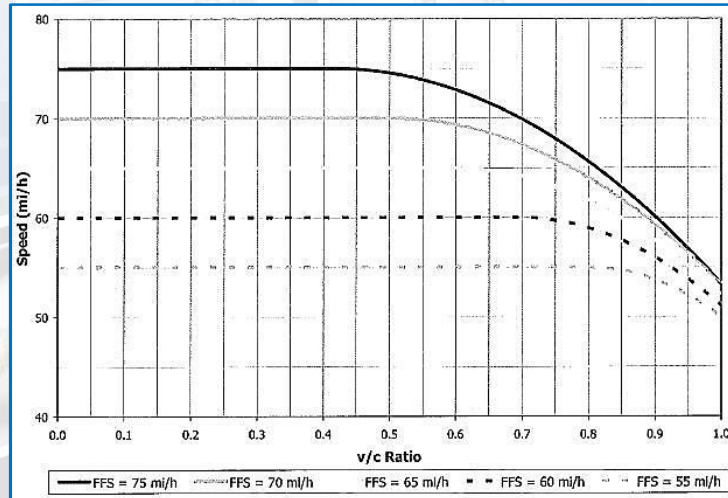
- HCM 2010 Exhibit 4-3



142

Basic Freeway Segments

- HCM 2010 Exhibit 11-14



143

Basic Freeway Segments

- HCM 2010 Exhibit 11-5 (LOS for Automobiles)

LOS	Density (pc/mi/ln)
A	≤11
B	>11-18
C	>18-26
D	>26-35
E	>35-45
F	Demand exceeds capacity >45

144

Basic Freeway Segments

Required Data

- Number of lanes, lane widths and lateral clearance
- Free-flow speed (FFS)
- Ramp density (ramps/mile)
 - On and off ramps (one direction) 3 miles upstream and 3 miles downstream of segment midpoint, divided by 6 miles
- Terrain
 - Level, rolling, mountainous, or length/percent grade
- Demand data
 - AADT, K factor and directional distribution (planning level)
 - Peak hour volumes and PHF
 - Percentage of heavy vehicles
 - Driver population factor

145

Basic Freeway Segments

Limitations

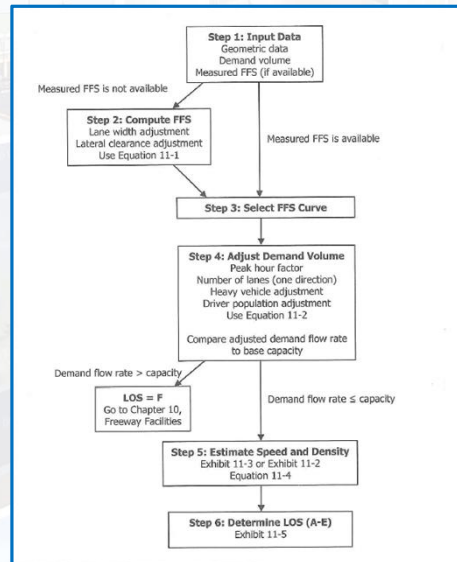
- Special lanes and lane control
 - HOV lanes, truck lanes, climbing lanes and lane changing restrictions
- Free-flow speed (FFS) below 55 mph and above 75 mph
- Influence from downstream queues
- Posted speed limit and enforcement
- Impacts of Intelligent Transportation Systems (ITS)
- Operations in construction zones, near toll plazas and extended bridge/tunnel segments
- Oversaturated conditions

146

Basic Freeway Segments

Methodology

- HCM 2010
Exhibit 11-7



147

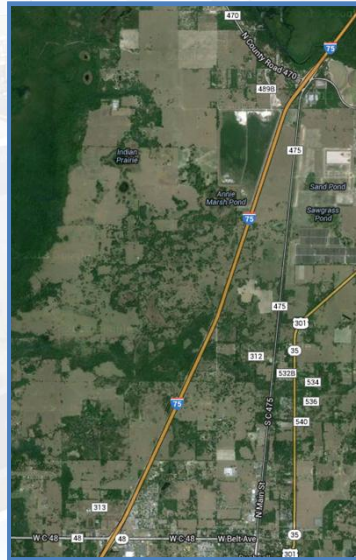
Basic Freeway Segments

Example #7: I-75 NB from CR 470 to FL-48 (Bushnell, FL)

- Select "Operations" Analysis, utilize Planning Data
 - AADT – 37,700 veh/day
 - K – 10%
 - D – 56%
- PHF – 0.88
- 2-lane freeway
- Level terrain
- 20% trucks and buses
- 75.4 MPH base free-flow speed
 - Lane width – 12.0 ft
 - Right-side lateral clearance – 6.0 ft
 - Total ramp density – 4 ramps/6 mi = 0.66 ramps/mi

148

Basic Freeway Segments



149

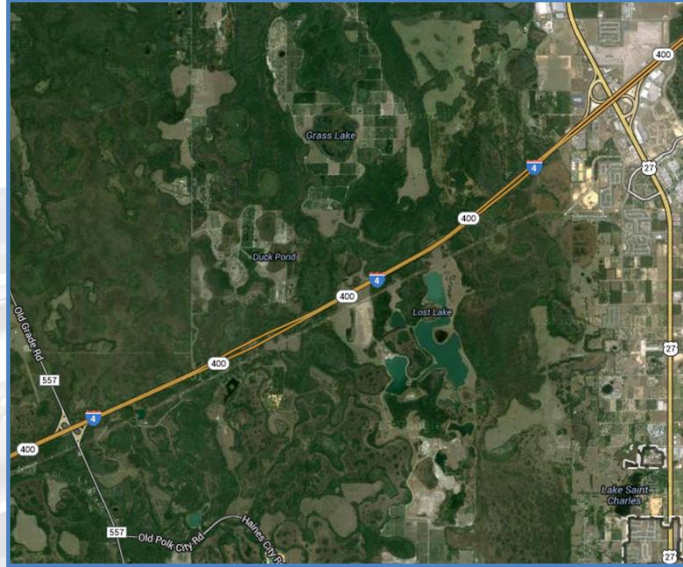
Basic Freeway Segments

Workshop #13: I-4 EB from CR 557 to US-27 (Haines City, FL)

- Select "Operations" Analysis, utilize Planning Data
 - AADT – 77,500 veh/day
 - K – 9% (FDOT "standard K")
 - D – 52%
- 3-lane freeway
- PHF – 0.92
- Level terrain
- 14% trucks and buses
- 75.4 MPH base free-flow speed
 - Lane width – 11.0 ft
 - Right-side lateral clearance – 3.0 ft
 - Total ramp density – 0 ramps/6 mi = 0.0 ramps/mi

150

Basic Freeway Segments



151

Basic Freeway Segments

Workshop #14: I-75 NB from Griffin Rd to Royal Palm Blvd (Hollywood, FL)

- Select "Operations" Analysis, use Planning Data
 - AADT – 149,500 veh/day
 - K – 9% (FDOT "standard K")
 - D – 54%
- PHF – 0.94
- 4-lane freeway
- Level terrain
- 6% trucks and buses
- Primarily commuter traffic
- 75.4 MPH base free-flow speed
 - Lane width - 12.0 ft
 - Right-side lateral clearance – 6.0 ft
 - Total ramp density – 6 ramps/6 mi = 1.0 ramp/mi

152

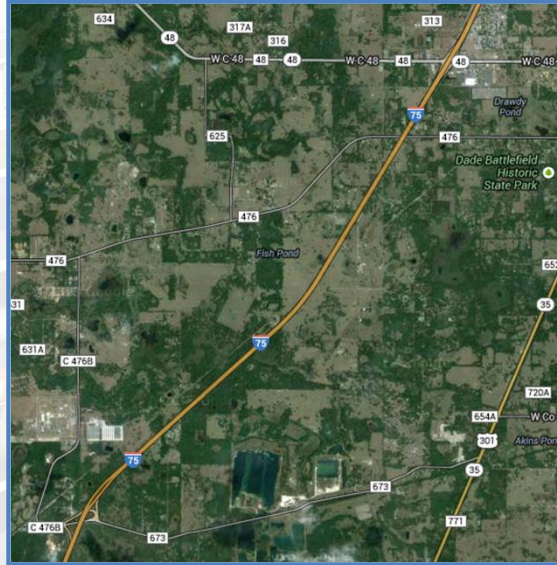
153

Workshop #15A: I-75 NB from CR 673 to FL-48 (Bushnell, FL)

- Select “Operations” analysis, but don’t check “Planning Data”
- Volume – 1,950 veh/hr
- PHF – 0.88
- Level terrain
- 2-lane freeway
- 20% trucks and buses
- 75.4 MPH base free-flow speed
 - Lane width – 11.0 ft
 - Right-side lateral clearance – 6.0 ft
 - Total ramp density – 4 ramps/6 mi = 0.66 ramps/mi

154

Basic Freeway Segments



155

Basic Freeway Segments

Workshop #15B: I-75 NB from CR 673 to FL-48 (Bushnell, FL)

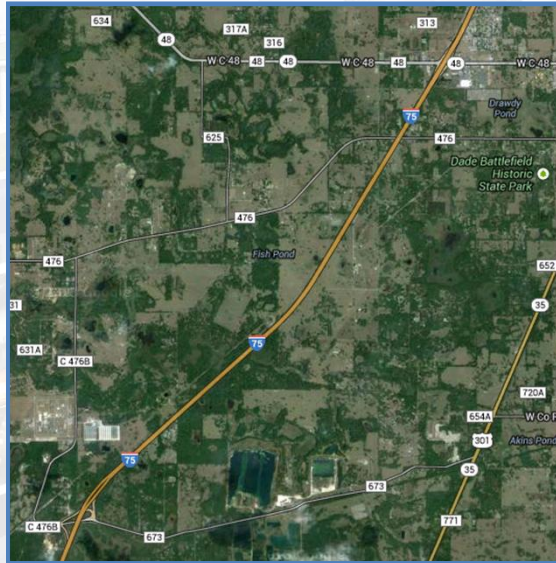
- Rather than Operations, select Design as the analysis type
 - Check box to enable Planning Data input fields
- Input same basic characteristics as Workshop #15A

How many lanes are required for LOS C?

- Assume:
 - AADT = 76,000 veh/day
 - K = 10%
 - D = 55%

156

Basic Freeway Segments



157

Day 3 – Uninterrupted Flow (Mostly)

- Interchanges
- Freeways
 - Basic segments
 - Weaving segments ◀
 - Merge and diverge segments
 - Freeway facilities
- Multi-lane highway segments
- Two-lane highway segments

158

FDOT HCS 2010

Weaving Segments

- Chapter 12 – HCM 2010
- Merge segments closely followed by diverge segments
- Three geometric characteristics affect a weaving segment:
 - Length of weaving segment based on short length
 - Width of weaving segment
 - Configuration
- Level-of-service criteria
 - Density (passenger cars/mile/lane)
- New methodology in HCM 2010 based on NCHRP 3-75
 - LOS F threshold changes

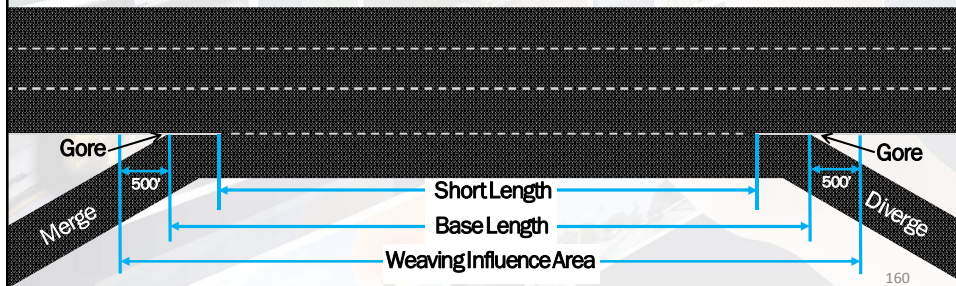
159

FDOT HCS 2010

Weaving Segments

Terminology

- Length of Weaving Segment: Distance between the merge and diverge that form the weaving segment
 - Short Length: Distance between barrier markings
 - Base Length: Gore to gore length



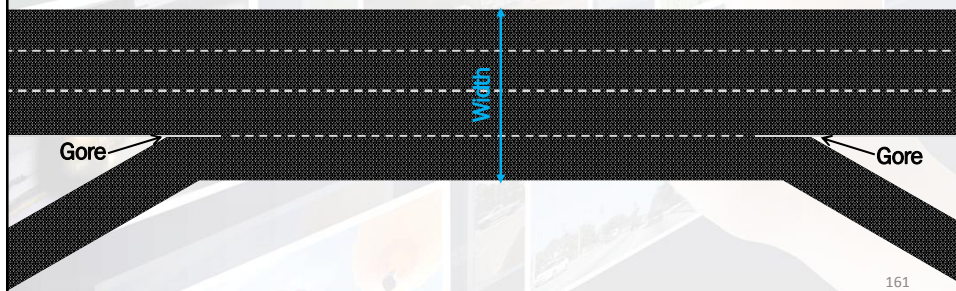
The diagram illustrates a weaving segment on a highway. It shows a merge area on the left and a diverge area on the right, separated by a central weaving section. Key measurements are indicated with blue arrows and labels: 'Gore' at the boundaries, 'Merge' and 'Diverge' for the transition areas, 'Short Length' for the distance between barrier markings, 'Base Length' for the distance from gore to gore, and 'Weaving Influence Area' for the total length of the weaving segment. A '500'' dimension is also shown for the merge and diverge areas. The slide number '160' is in the bottom right corner.

160

Weaving Segments

Terminology

- Width of Weaving Segment : Number of continuous lanes within a weaving segment
 - Number of lanes between the entry and exit gore



161

Weaving Segments

Terminology

- One-Sided Weaving Segment: Weaving maneuvers require no more than two lane changes
- One-sided ramp weave shown

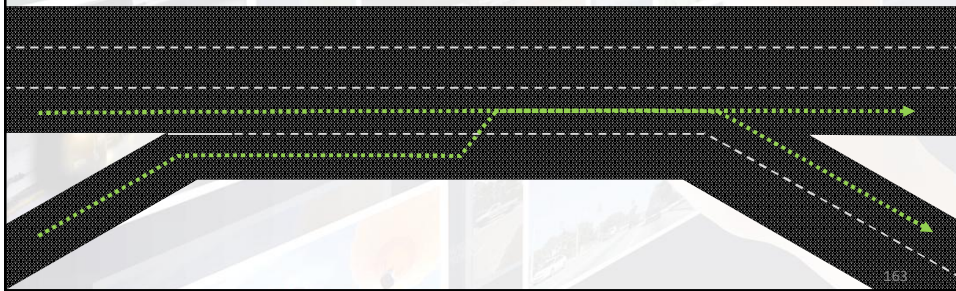


162

Weaving Segments

Terminology

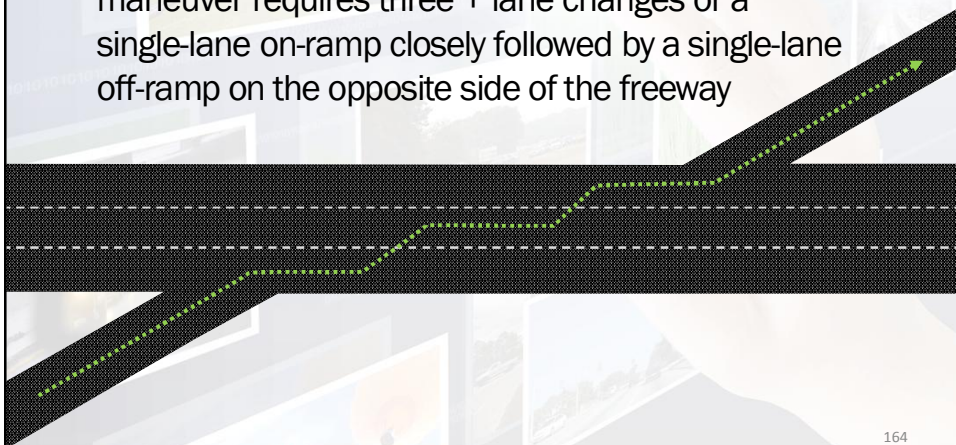
- One-Sided Weaving Segment: Weaving maneuvers require no more than two lane changes
- One-sided major weave shown



Weaving Segments

Terminology

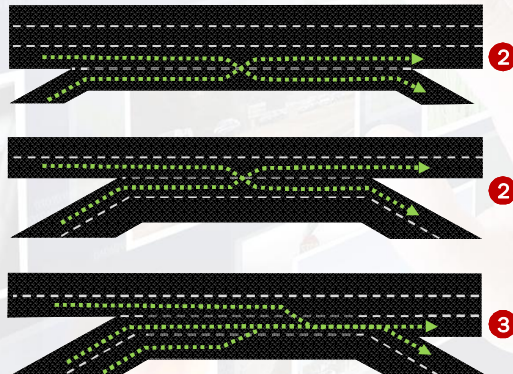
- Two-Sided Weaving Segment: At least one weaving maneuver requires three + lane changes or a single-lane on-ramp closely followed by a single-lane off-ramp on the opposite side of the freeway



Weaving Segments

Maneuver Lanes

- Number of lanes from which a weaving maneuver may be completed with one lane change or no lane changes



165

Weaving Segments

Minimum Lane Changes

- Minimum number of lane changes that must be made by a single weaving vehicle to successfully execute a:
 - Ramp to Freeway maneuver
 - Freeway to Ramp maneuver
 - Ramp to Ramp maneuver

Assume that every weaving vehicle enters in the lane closest to their desired exit leg and leaves the segment in the lane closest to their entry leg. This is only applicable for one-sided weaving segments.

166

Weaving Segments

Minimum Lane Changes

- Ramp to Freeway
- Freeway to Ramp
- Ramp to Ramp



Weaving Segments

- HCM 2010 Exhibit 12-10 (LOS for Automobiles)

LOS	Density (pc/mi/ln)	
	Freeway Weaving Segments	Weaving Segments on Multilane Highways or C-D Roadways
A	0-10	0-12
B	>10-20	>12-24
C	>20-28	>24-32
D	>28-35	>32-36
E	>35	>36
F	Demand exceeds capacity	

FDOT **HCS 2010**

Weaving Segments

Required Data

- Roadway configuration
 - Number of lanes on entry and exit legs
 - Number of lanes within weaving segment
 - Length of roadway segment
- Demand data
 - Volumes and PHF
 - Freeway to freeway, freeway to ramp, ramp to freeway, and ramp to ramp
 - Percentage of heavy vehicles

169

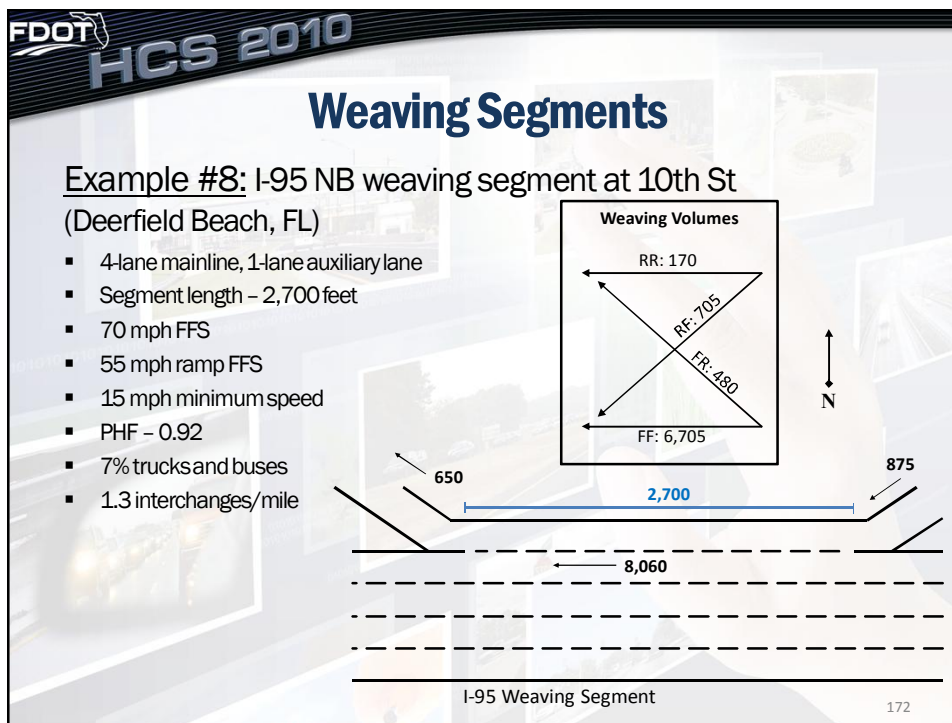
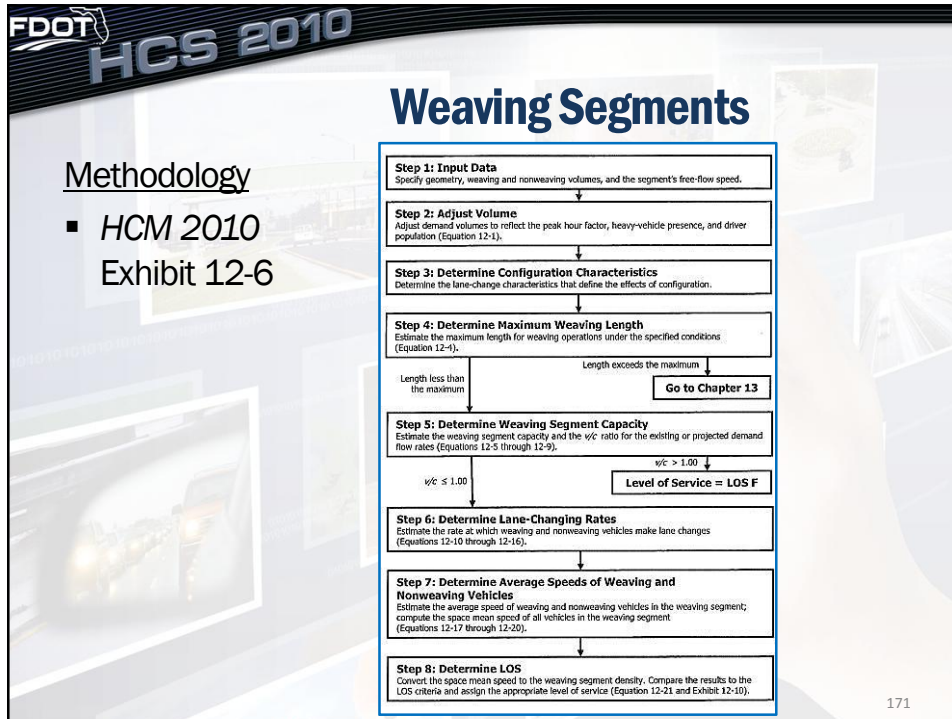
FDOT **HCS 2010**

Weaving Segments

Limitations

- Special lanes within weaving segment
 - HOV lanes, truck lanes, climbing lanes
- Ramp metering
- Influence from downstream congestion
- Posted speed limit and enforcement
- Impacts of Intelligent Transportation Systems (ITS)
- Weaving segments on arterials or urban streets
- Oversaturated conditions
- Multiple weaving segments

170



Weaving Segments

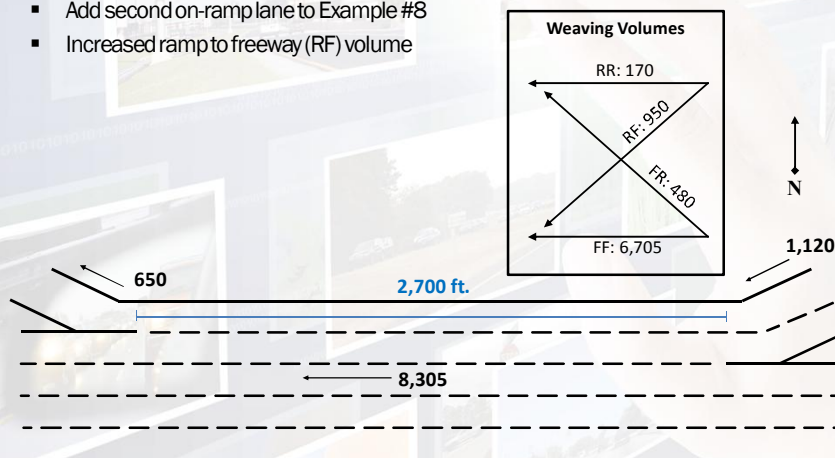


173

Weaving Segments

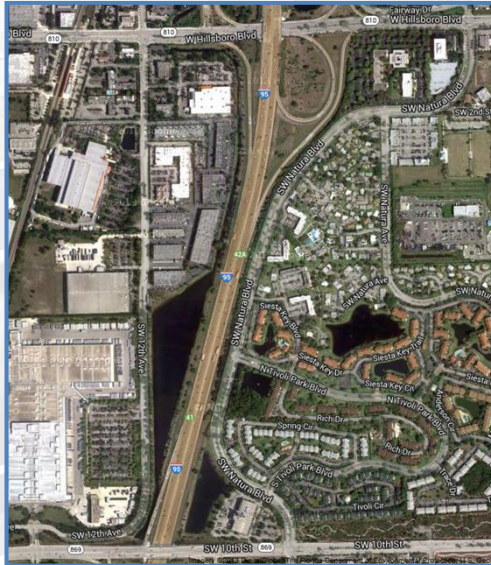
Workshop #16: Sample Weaving Segment

- Add second on-ramp lane to Example #8
- Increased ramp to freeway (RF) volume



174

Weaving Segments

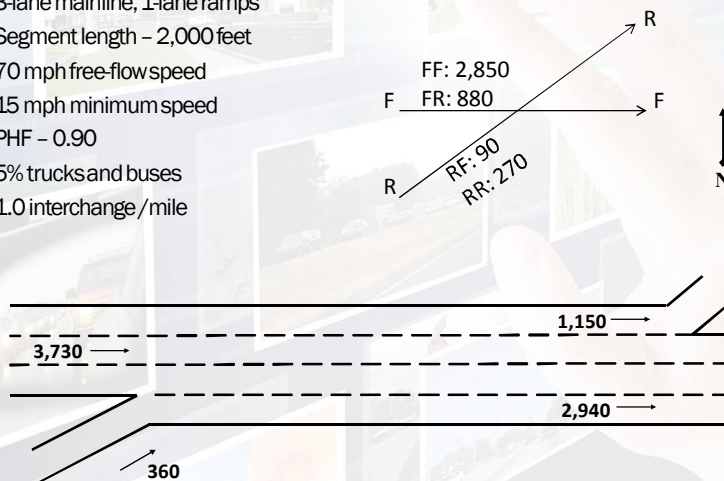


175

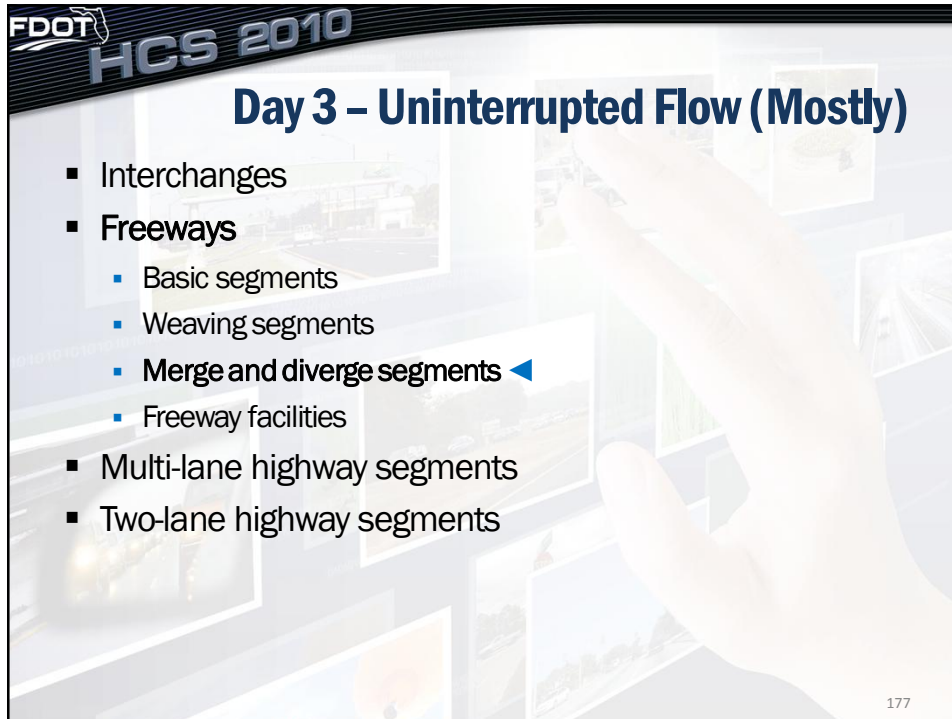
Weaving Segments

Workshop #17: Sample Weaving Segment

- 3-lane mainline, 1-lane ramps
- Segment length – 2,000 feet
- 70 mph free-flow speed
- 15 mph minimum speed
- PHF – 0.90
- 5% trucks and buses
- 1.0 interchange/mile



176

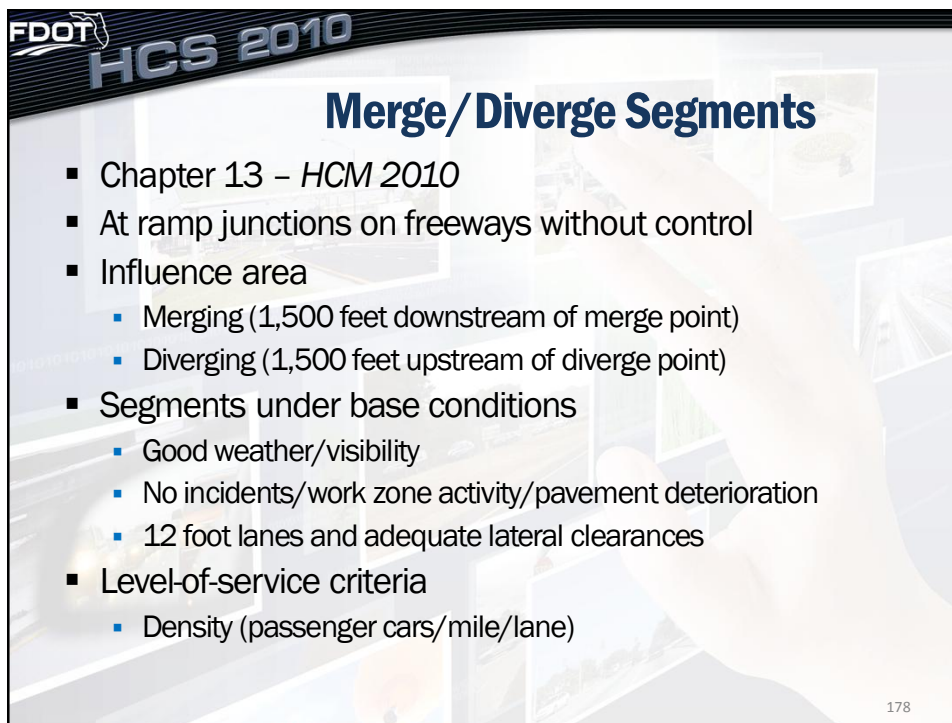


FDOT HCS 2010

Day 3 – Uninterrupted Flow (Mostly)

- Interchanges
- **Freeways**
 - Basic segments
 - Weaving segments
 - **Merge and diverge segments** ◀
 - Freeway facilities
- Multi-lane highway segments
- Two-lane highway segments

177



FDOT HCS 2010

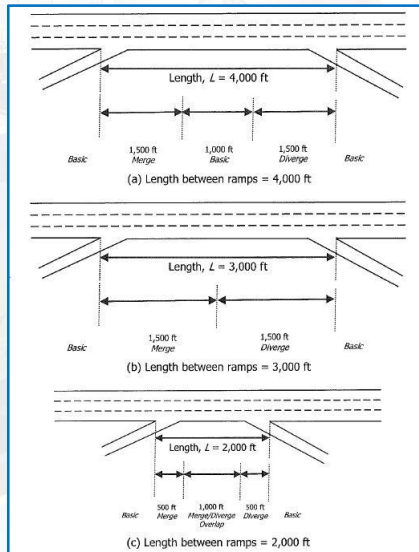
Merge/Diverge Segments

- Chapter 13 – *HCM 2010*
- At ramp junctions on freeways without control
- Influence area
 - Merging (1,500 feet downstream of merge point)
 - Diverging (1,500 feet upstream of diverge point)
- Segments under base conditions
 - Good weather/visibility
 - No incidents/work zone activity/pavement deterioration
 - 12 foot lanes and adequate lateral clearances
- Level-of-service criteria
 - Density (passenger cars/mile/lane)

178

Merge/Diverge Segments

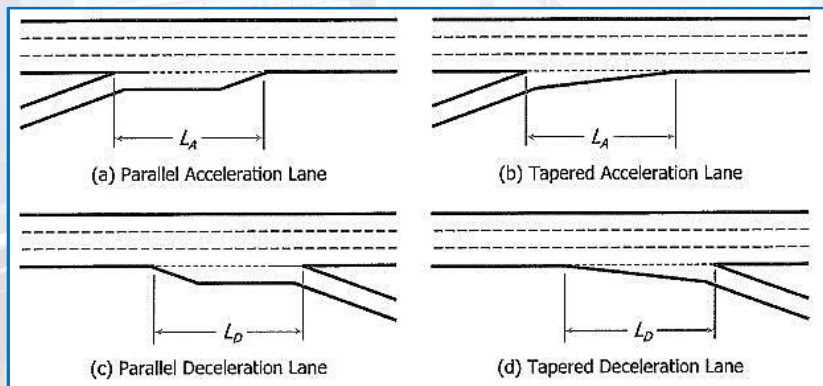
- HCM 2010
Exhibit 10-12



179

Merge/Diverge Segments

- HCM 2010 Exhibit 13-3



180

Merge/Diverge Segments

- HCM 2010 Exhibit 13-2 (LOS for Automobiles)

LOS	Density (pc/mi/ln)	Comments
A	≤10	Unrestricted operations
B	>10–20	Merging and diverging maneuvers noticeable to drivers
C	>20–28	Influence area speeds begin to decline
D	>28–35	Influence area turbulence becomes intrusive
E	>35	Turbulence felt by virtually all drivers
F	Demand exceeds capacity	Ramp and freeway queues form

181

Merge/Diverge Segments

Required Data

- Freeway information
 - Number of lanes
 - Free-flow speed ranging from 55 mph to 75 mph
 - Terrain: level, rolling, mountainous, or length/percent grade
- Ramp information
 - Type of ramp and side of junction (right- or left-hand)
 - Number of lanes, length of acceleration/deceleration lane(s)
 - Free-flow speed ranging from 20 mph to 50 mph
 - Terrain: level, rolling, mountainous, or length/percent grade

182



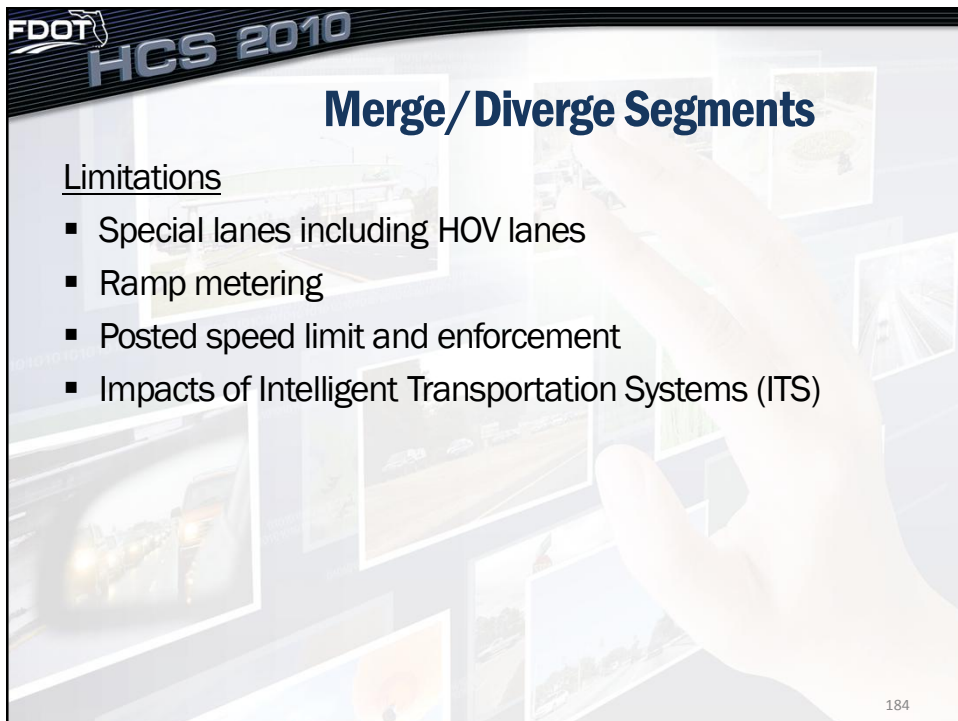
FDOT
HCS 2010

Merge/Diverge Segments

Required Data (cont)

- Demand data
 - Volumes and PHF
 - Percentage of heavy vehicles
 - Driver population factor

183



FDOT
HCS 2010

Merge/Diverge Segments

Limitations

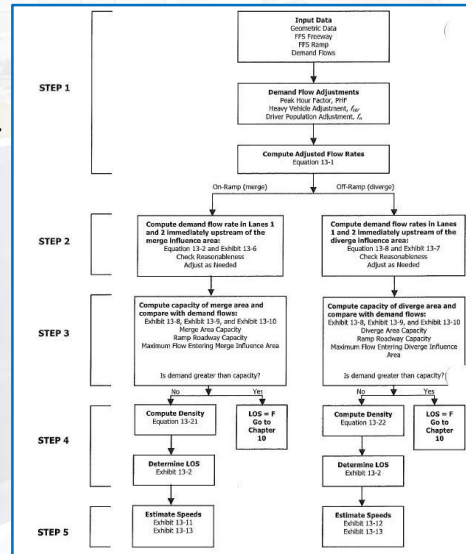
- Special lanes including HOV lanes
- Ramp metering
- Posted speed limit and enforcement
- Impacts of Intelligent Transportation Systems (ITS)

184

Merge/Diverge Segments

Methodology

- HCM 2010 Exhibit 13-4

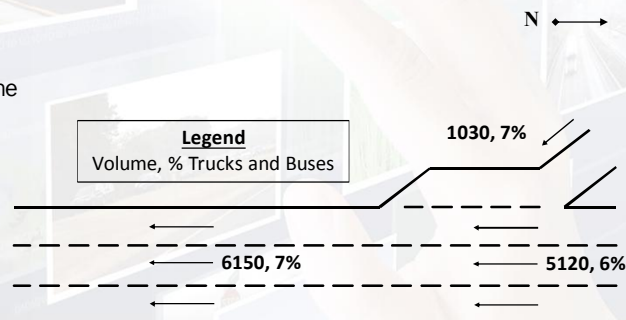


185

Merge/Diverge Segments

Example #9: I-75 SB/Griffin Road merge (Hollywood, FL)

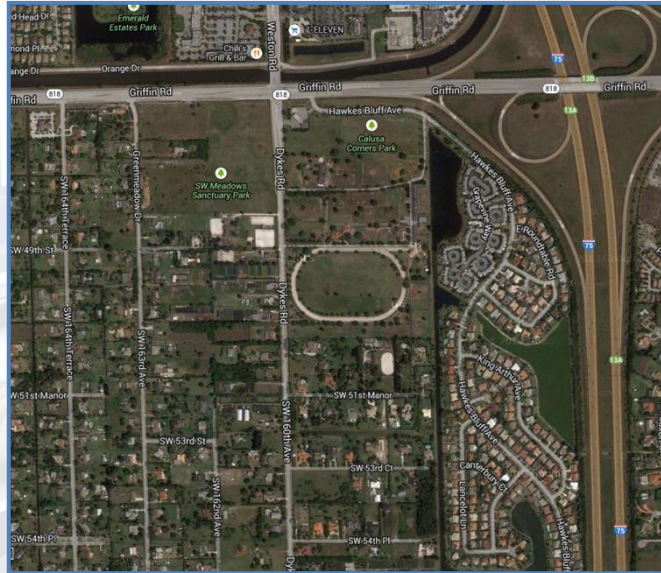
- 3-lane mainline, 1-lane ramp
- 70 mph mainline FFS
- 40 mph ramp FFS
- 1130 ft. acceleration lane
- PHF = 0.94
- 1% grade for 0.5 miles



I-75 / Griffin Road Merge

186

Merge/Diverge Segments

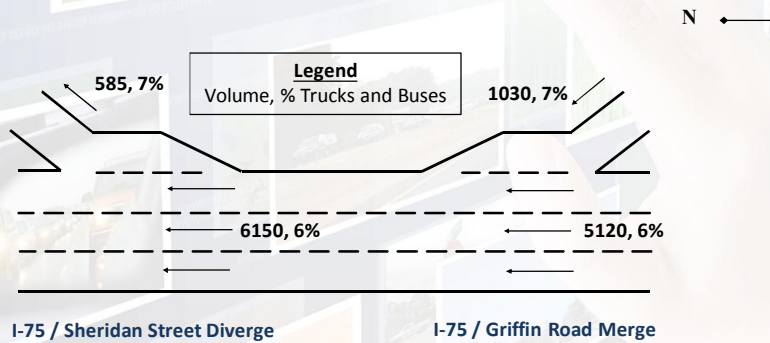


187

Merge/Diverge Segments

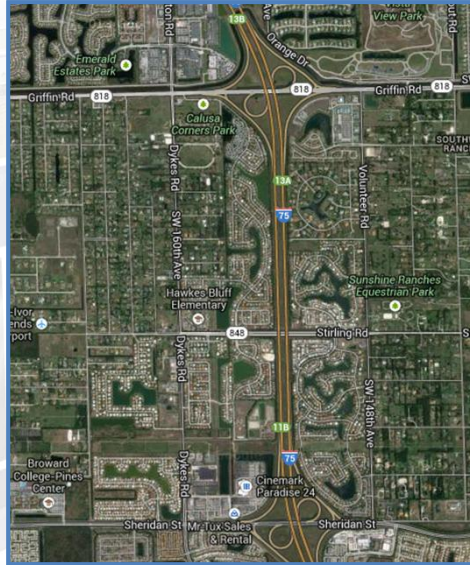
Workshop #18: I-75 SB merge (Hollywood, FL)

- Now, take into account the downstream off-ramp (6,800 ft. away)



188

Merge/Diverge Segments

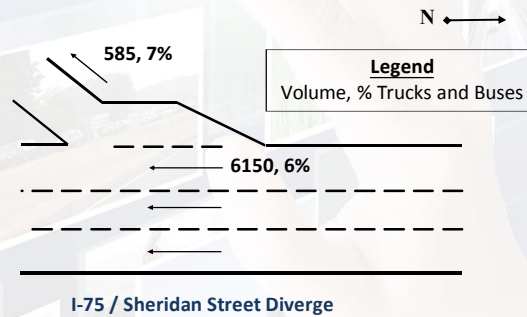


189

Merge/Diverge Segments

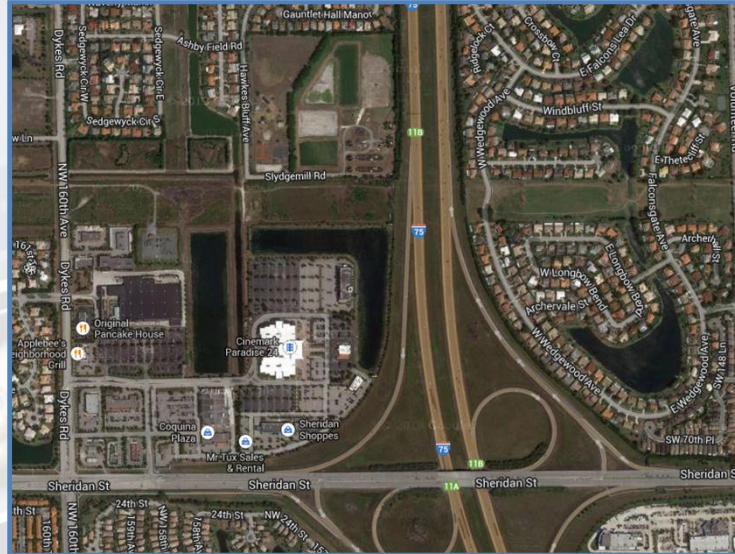
Workshop #19: I-75 SB/Sheridan Street diverge (Hollywood, FL)

- 3-lane mainline, 1-lane ramp
- 70 mph mainline FFS
- 40 mph ramp FFS
- 480 ft. deceleration lane
- PHF - 0.94
- Level terrain



190

Merge/Diverge Segments

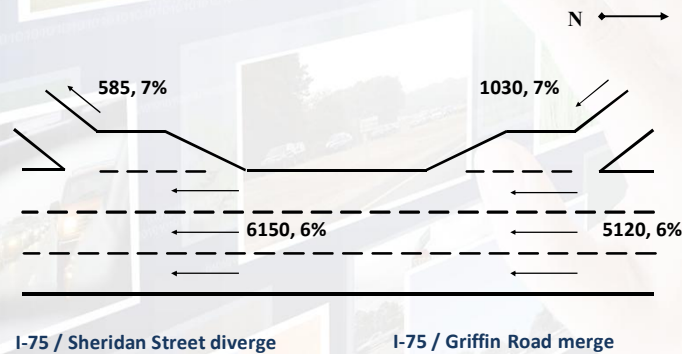


191

Merge/Diverge Segments

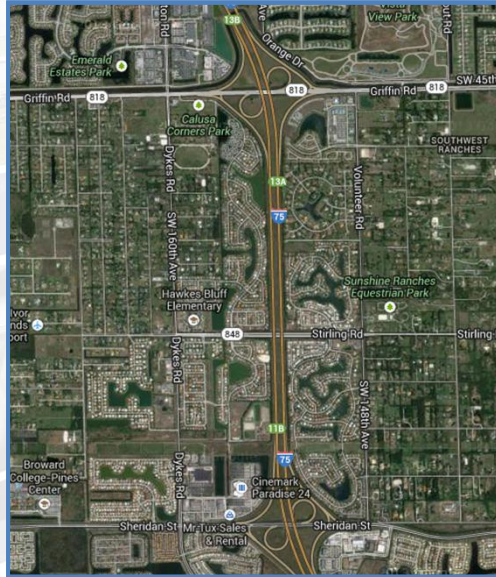
Workshop #20: I-75 SB/Sheridan Street diverge
(Hollywood, FL)

- Now, take into account the upstream on-ramp (2,000 ft. away)



192

Merge/Diverge Segments



193

Day 3 – Uninterrupted Flow (Mostly)

- Interchanges
- Freeways
 - Basic segments
 - Weaving segments
 - Merge and diverge segments
 - Freeway facilities ◀
- Multi-lane highway segments
- Two-lane highway segments

194

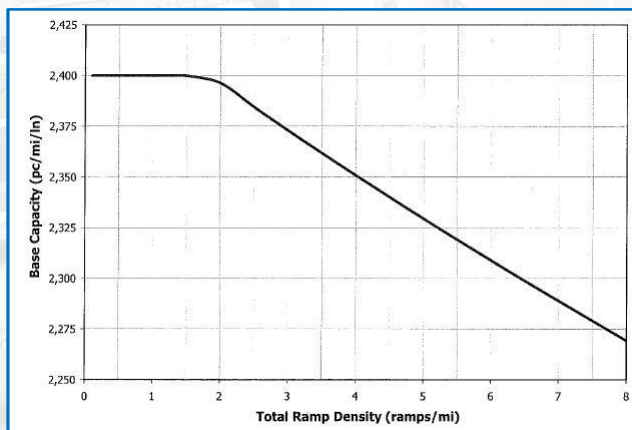
Freeway Facilities

- Chapter 10 – HCM 2010
- Extended lengths of freeways
 - Including continuously connected basic freeway, weaving, merge, and diverge segments
- Multiple and continuous 15-min time periods
- Accounts for the spreading of impacts of breakdowns
- Freeway facility capacity is based on the capacity of the critical segment
 - Critical segment – the segment that will breakdown first
- Level-of-service criteria
 - Density (passenger cars/mile/lane)

195

Freeway Facilities

- HCM 2010 Exhibit 10-6



196

Freeway Facilities

- HCM 2010 Exhibit 10-7 (LOS for Automobiles)

Level of Service	Density (pc/mi/ln)
A	≤11
B	>11–18
C	>18–26
D	>26–35
E	>35–45
F	>45 or any component v_f/c ratio > 1.00

197

Freeway Facilities

Required Data

- Freeway information
 - Number of lanes, free flow speed (FFS) - 55 mph to 75 mph
 - Terrain: level, rolling, mountainous, or length/percent grade
- Ramp information
 - Type of ramp and side of junction (right- or left-hand)
 - Number of lanes, length of acceleration/deceleration lane(s)
 - Free-flow speed ranging from 20 mph to 50 mph
 - Terrain: level, rolling, mountainous, or length/percent grade

198

FDOT **HCS 2010**

Freeway Facilities

Required Data

- Demand Data
 - Volumes and PHF
 - Percentage of heavy vehicles
 - Driver population factor

199

FDOT **HCS 2010**

Freeway Facilities

Limitations

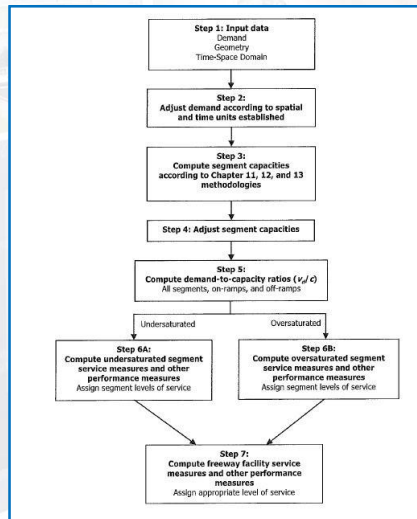
- Multiple overlapping breakdowns or bottlenecks
- The effects of traffic management strategies
- System-wide oversaturation flow conditions
- Conditions where demand-to-capacity ratios > 1.00
- HOV Lanes
 - HOV operating characteristics and their effect on rest of freeway
 - The interaction between HOV lanes and mixed-flow lanes
- The effects of off-ramp capacity issues
- The effects of toll plaza operations

200

Freeway Facilities

Methodology

- HCM 2010
Exhibit 10-10



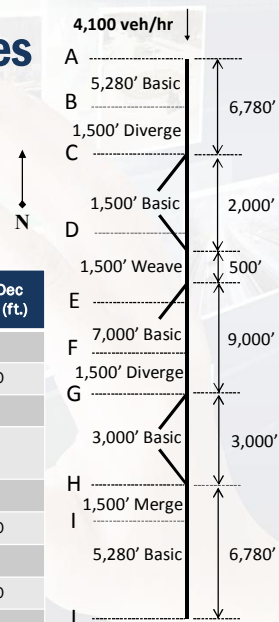
201

Freeway Facilities

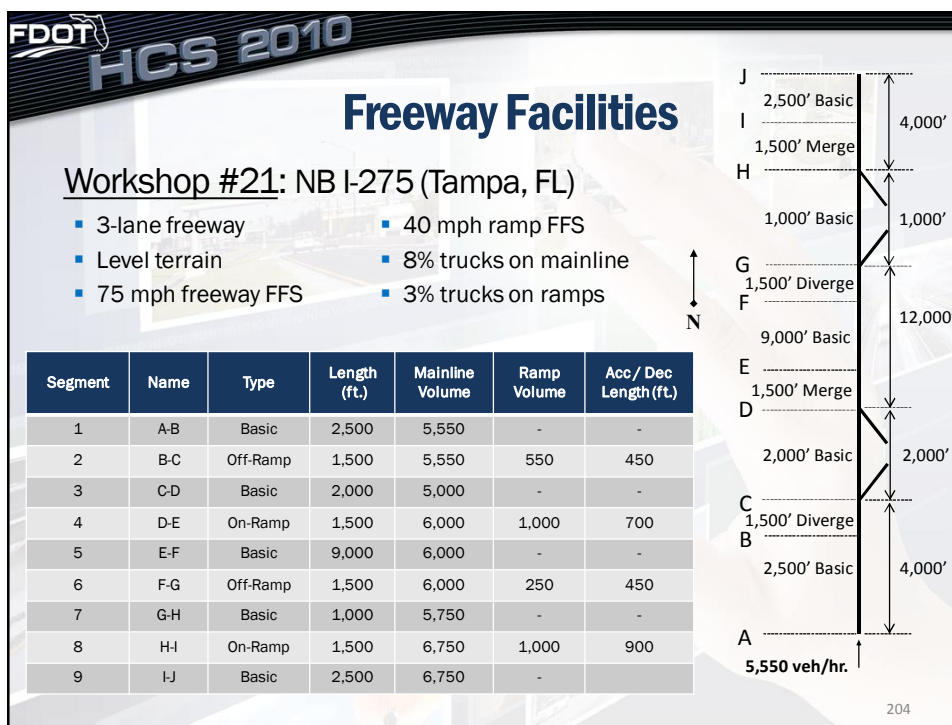
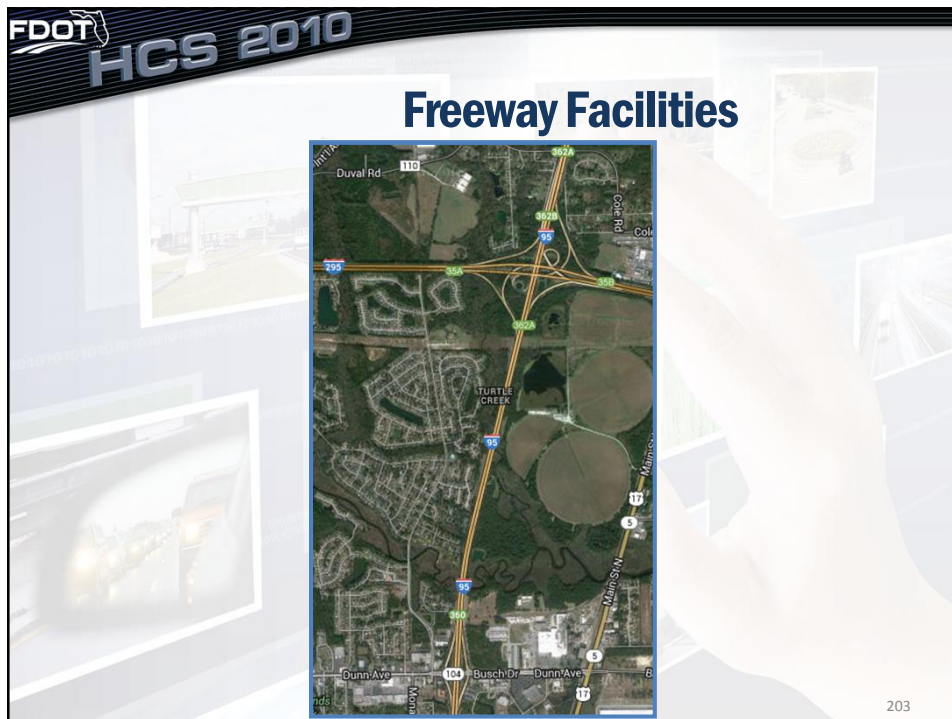
Example #10: I-95 SB (Jacksonville, FL)

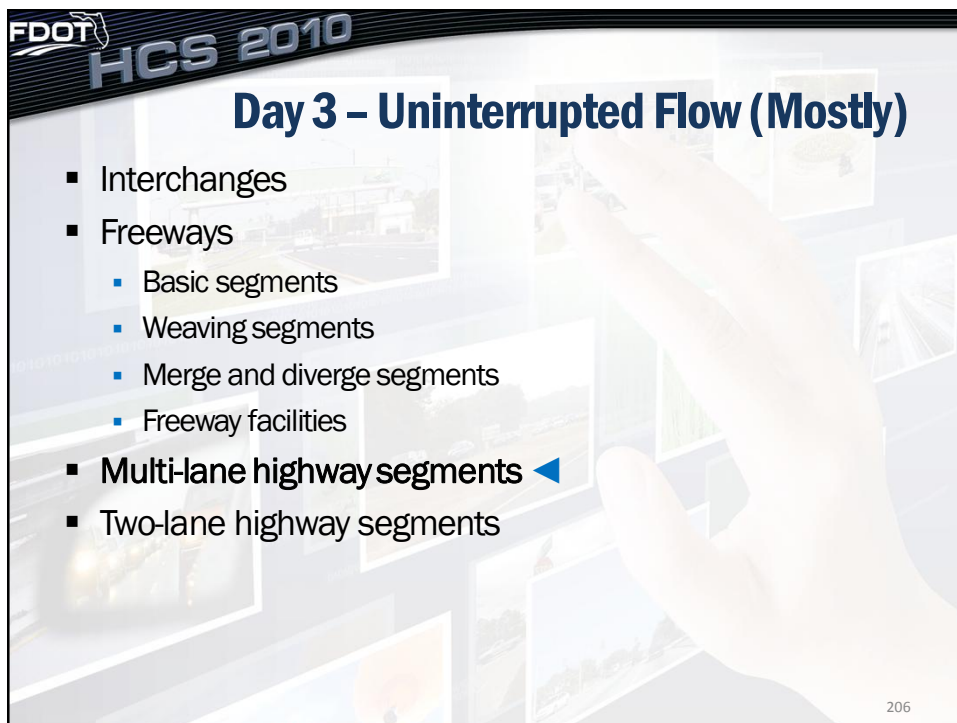
- 3-lane freeway
- 40 mph ramp FFS
- Level terrain
- 10% trucks
- 70 mph freeway FFS

Segment	Name	Type	Length (ft.)	Mainline Volume	Ramp Volume	Acc/Dec Length (ft.)
1	A-B	Basic	5,280	4,100	-	-
2	B-C	Off-Ramp	1,500	4,100	1,700	850
3	C-D	Basic	1,500	2,400	-	-
4	D-E	Weaving	1,500	2,600	On: 200 Off: 400	-
5	E-F	Basic	7,000	2,200	-	-
6	F-G	Off-Ramp	1,500	2,200	500	600
7	G-H	Basic	3,000	1,700	-	-
8	H-I	On-Ramp	1,500	2,600	900	600
9	I-J	Basic	5,280	2,600	-	-



202





Multi-Lane Highways

- Chapter 14 – HCM 2010
- For situations where signalized intersections are 2 miles or more apart
 - Use urban streets module where signals are more closely spaced
- Four- to six-lane facilities
 - Divided and undivided including two-way left-turn lane (TWLTL)
- Level-of-service criteria
 - Density (automobiles)
 - Bicycle LOS Score (bicycles)

207

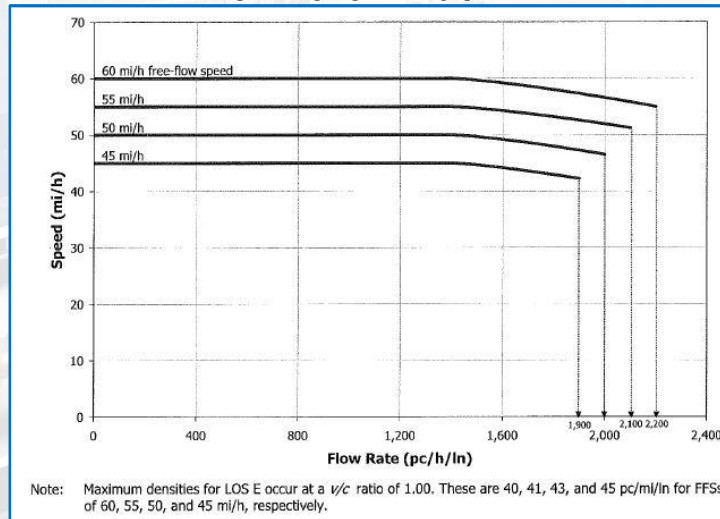
Multi-Lane Highways



208

Multi-Lane Highways

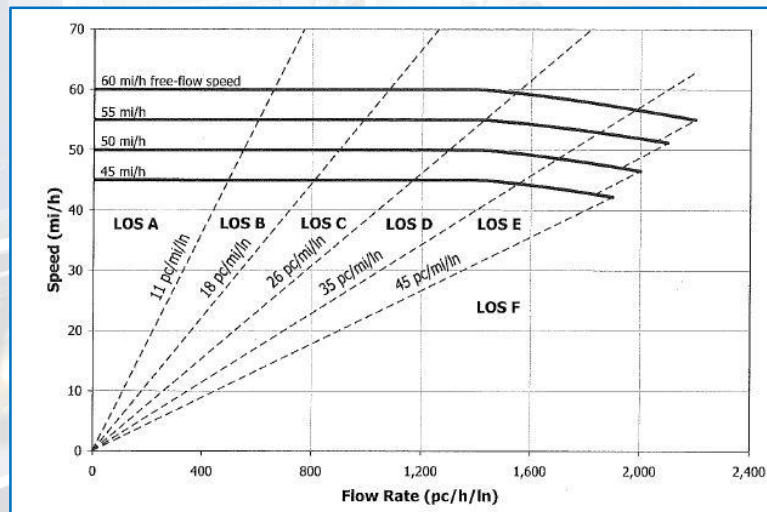
■ HCM 2010 Exhibit 14-2



209

Multi-Lane Highways

■ HCM 2010 Exhibit 14-5



210

Multi-Lane Highways

- HCM 2010 Exhibit 14-4 (LOS for Automobiles)

LOS	FFS (mi/h)	Density (pc/mi/ln)
A	All	>0-11
B	All	>11-18
C	All	>18-26
D	All	>26-35
E	60	>35-40
	55	>35-41
	50	>35-43
	45	>35-45
Demand Exceeds Capacity		
F	60	>40
	55	>41
	50	>43
	45	>45

- HCM 2010 Exhibit 14-6 (LOS for Bicycles)

LOS	Bicycle LOS Score
A	≤1.5
B	>1.5-2.5
C	>2.5-3.5
D	>3.5-4.5
E	>4.5-5.5
F	>5.5

211

Multi-Lane Highways

Required Data

- Number of lanes, lane widths, and lateral clearance
- Median type: divided, TWLTL, or undivided
- Free-flow speed (FFS) between 45 and 60 mph
- Access-point density (accesses/mile) between 0 and 40
- Terrain type
 - Level, rolling, mountainous, or length/percent grade
- Demand data
 - AADT, K factor and directional distribution (planning level)
 - Volumes and PHF
 - Percentage of heavy vehicles
 - Driver population factor

212

Multi-Lane Highways

Limitations

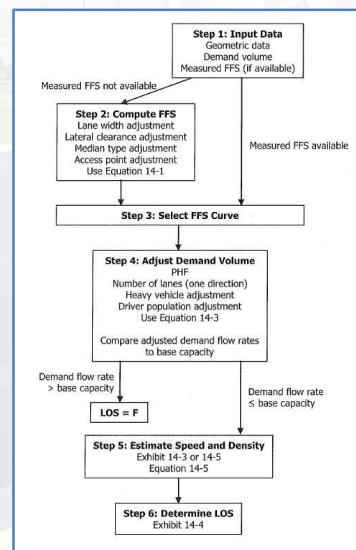
- Free-flow speed less than 45 mph and more than 60 mph
- The effect of lane drops/additions
- Downstream queuing effects
- Differences between median treatments
 - Barriers, raised curb and TWLTL
- The presence of on-street parking
- Significant transit and pedestrian activity
- The impacts of weather and incidents

213

Multi-Lane Highways

Methodology

- HCM 2010
- Exhibit 14-7



214

Multi-Lane Highways

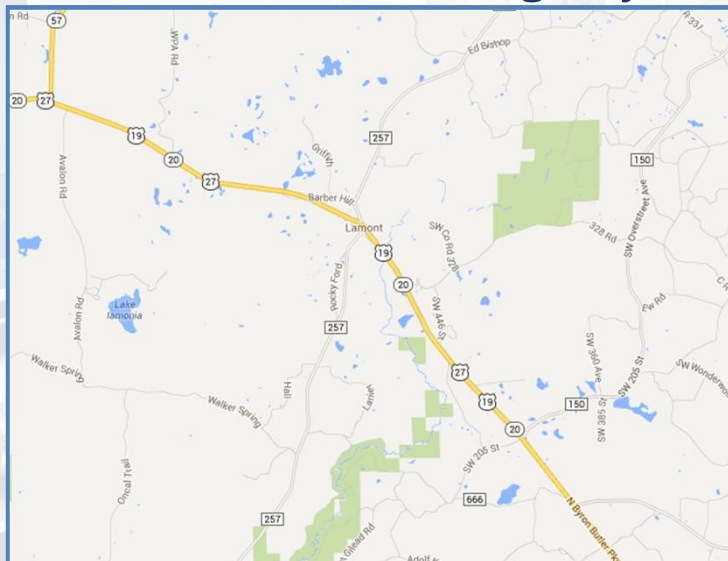
Example #11: US-19/27 from Avalon Rd to CR 14
(Lamont, FL)

- 4-lane divided highway
- 65 mph base FFS
- 12 ft. lane width
- 6 ft. lateral clearance
on both edges
- Level terrain

Direction	Southbound	Northbound
Access Points per Mile	2	3
Hourly Volume	260	220
PHF	0.88	0.88
Trucks and Buses	12%	16%

215

Multi-Lane Highways



216

Multi-Lane Highways

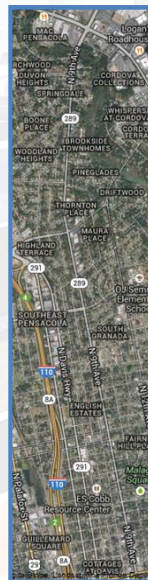
Workshop #22: SR 289 (Pensacola, FL)

- 4-lane undivided highway
- 50 MPH speed limit posted
 - 55 base free-flow speed
- 12 ft. lane width
- No lateral clearance on right edge
- Level terrain
- No on-street parking available
- Pavement rating: 5

Direction	Southbound	Northbound
Access Points per Mile	30	35
Hourly Volume	765	975
PHF	0.92	0.85
Trucks and Buses	5%	2%

217

Multi-Lane Highways



218

Multi-Lane Highways

Workshop #23: US-301 (Wildwood, FL)

- 4-lane highway with TWLTL
- 40 MPH speed limit posted
 - 45 MPH base free-flow speed
- 12 ft. lane width
- 8 ft. lateral clearance on right edge
- Level terrain
- No on-street parking available
- Pavement rating: 4

Direction	Southbound	Northbound
Access Points per Mile	18	23
Hourly Volume	690	890
PHF	0.94	0.90
Trucks and Buses	11%	13%

219

Multi-Lane Highways



220

Multi-Lane Highways

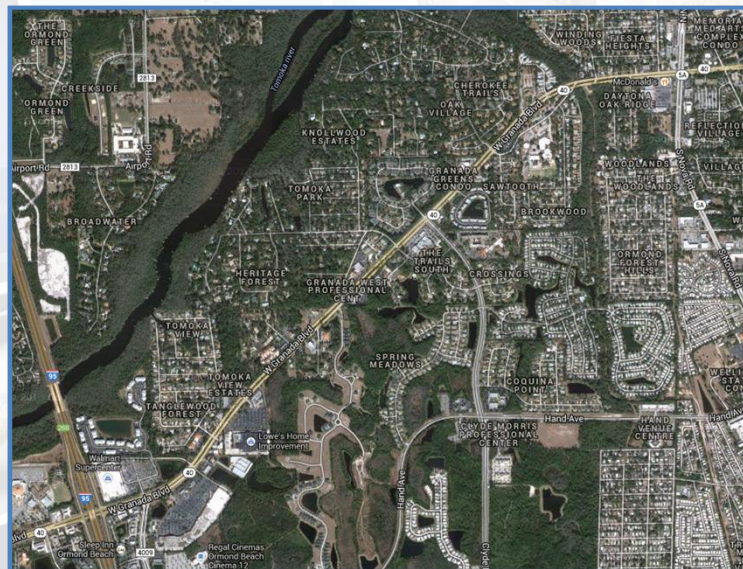
Workshop #24: SR 40 (Ormond Beach, FL)

- 4-lane divided highway
- 45 MPH posted speed limit
 - 50 MPH base free-flow speed
- 11 ft. lane width
- 6 ft. lateral clearance on left edge
- No clearance on right edge
- Level terrain
- Driver population factor: 0.90
- No on-street parking available
- Pavement rating: 3

Direction	Eastbound	Westbound
Access Points per Mile	11	15
Hourly Volume	1,840	1,130
PHF	0.84	0.78
Trucks and Buses	9%	20%

221

Multi-Lane Highways



222

Multi-Lane Highways

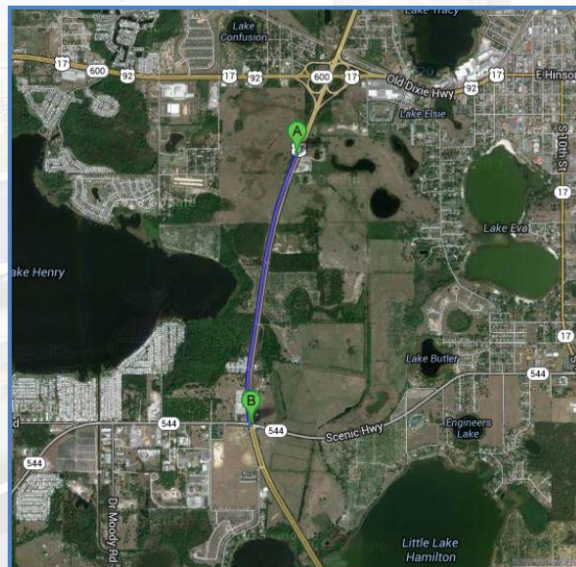
Workshop #25: US 27 (Haines City, FL)

- 6-Lane divided highway
- 50 mph posted speed limit
 - 55 mph base free-flow speed
- 12 ft. lane width
- 6 ft. lateral clearance to the left and right
- Level terrain
- No on-street parking available
- Pavement rating: 4

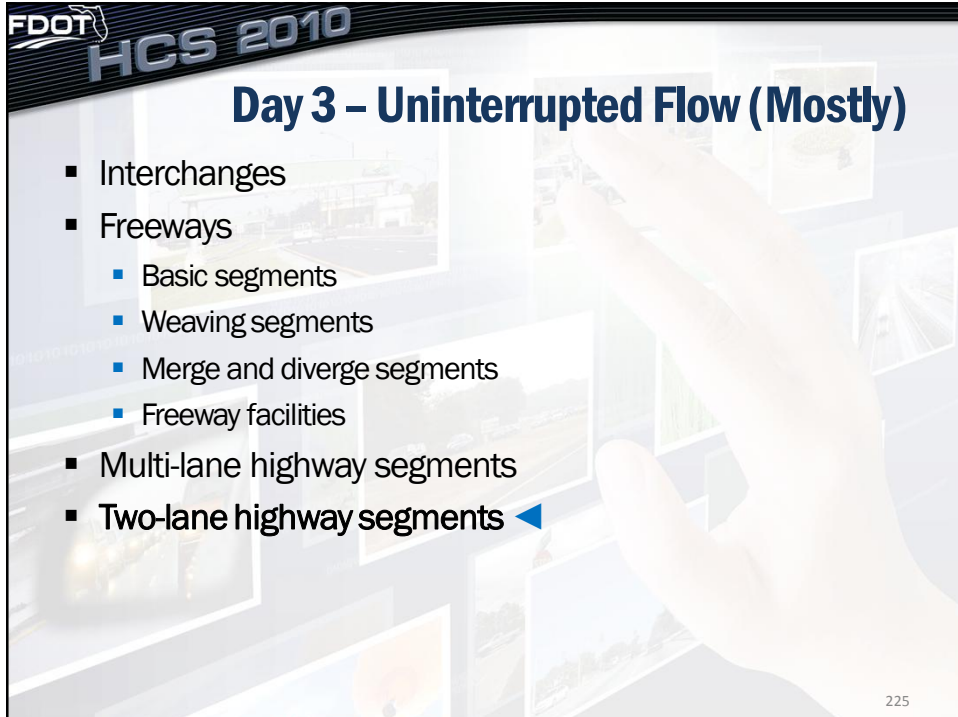
Direction	Eastbound	Westbound
Access Points per Mile	8	8
Hourly Volume	1,845	1,845
PHF	0.92	0.92
Trucks and Buses	9%	9%

223

Multi-Lane Highways



224

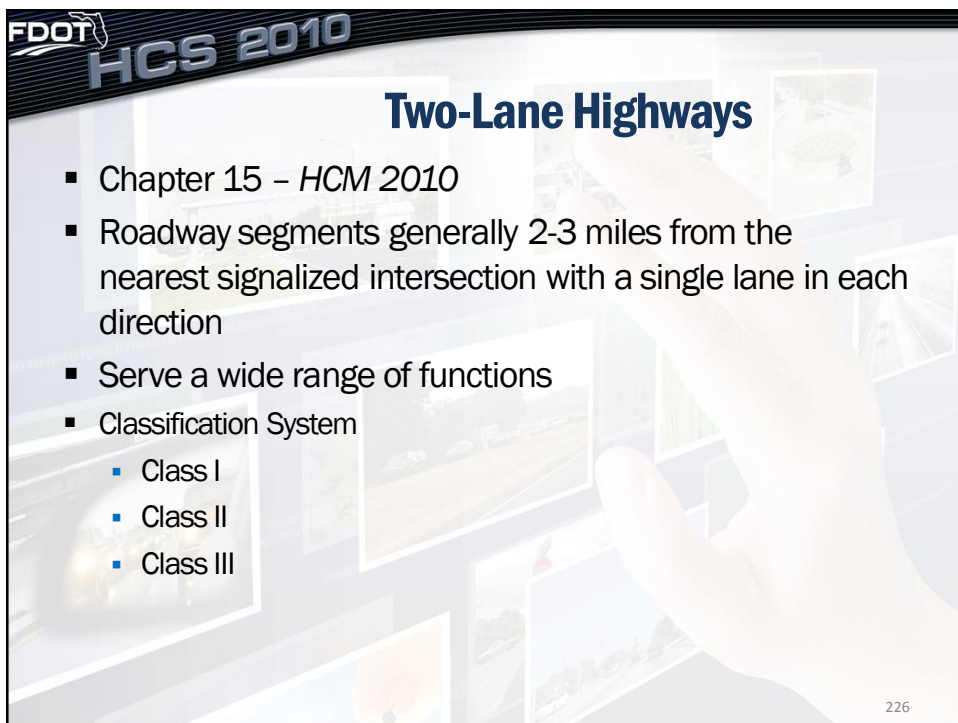


FDOT HCS 2010

Day 3 – Uninterrupted Flow (Mostly)

- Interchanges
- Freeways
 - Basic segments
 - Weaving segments
 - Merge and diverge segments
 - Freeway facilities
- Multi-lane highway segments
- Two-lane highway segments ◀

225



FDOT HCS 2010

Two-Lane Highways

- Chapter 15 – *HCM 2010*
- Roadway segments generally 2-3 miles from the nearest signalized intersection with a single lane in each direction
- Serve a wide range of functions
- Classification System
 - Class I
 - Class II
 - Class III

226

Two-Lane Highways

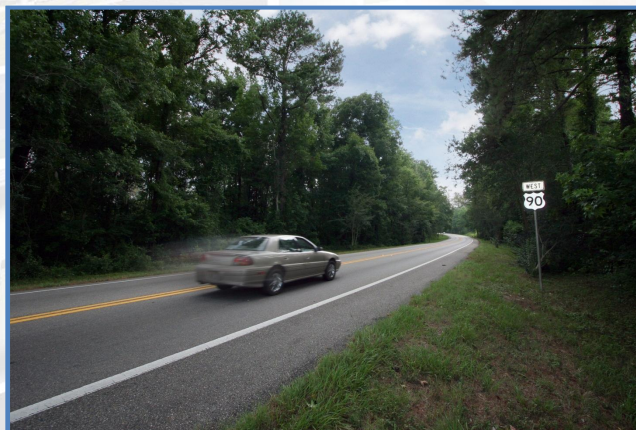
Class I Highway – Primary connectors, long-distance trips, and high travel speeds



227

Two-Lane Highways

Class II Highway – Scenic routes, areas with rugged terrain and/or low expected speeds



228

Two-Lane Highways

Class III Highway – Moderately developed areas such as towns with more access points



229

Two-Lane Highways

- Passing occurs in the opposing travel lane
- LOS criteria for automobiles
 - Average Travel Speed (ATS)
 - Percent Time-Spent-Following (PTSF)
 - Percent of Free-Flow Speed (PFFS)
- LOS criteria for bicycles
 - LOS Score

230

Two-Lane Highways

- HCM 2010 Exhibit 15-3 (LOS for Automobiles)

LOS	Class I Highways		Class II Highways	Class III Highways
	ATS (mi/h)	PTSF (%)	PTSF (%)	PFFS (%)
A	>55	≤35	≤40	>91.7
B	>50-55	>35-50	>40-55	>83.3-91.7
C	>45-50	>50-65	>55-70	>75.0-83.3
D	>40-45	>65-80	>70-85	>66.7-75.0
E	≤40	>80	>85	≤66.7

- HCM 2010 Exhibit 15-4 (LOS for Bicycles)

LOS	BLOS Score
A	≤1.5
B	>1.5-2.5
C	>2.5-3.5
D	>3.5-4.5
E	>4.5-5.5
F	>5.5

231

Two-Lane Highways

Required Data

- Highway class – I, II, or III
- Lane widths, shoulder width and terrain
- Speed limit and base design speed
- Access point density (one side)
- Percent no-passing and/or passing lane length
- Demand data
 - Volumes and PHF
 - Percentage of heavy vehicles
 - Directional split

232

Two-Lane Highways

Limitations

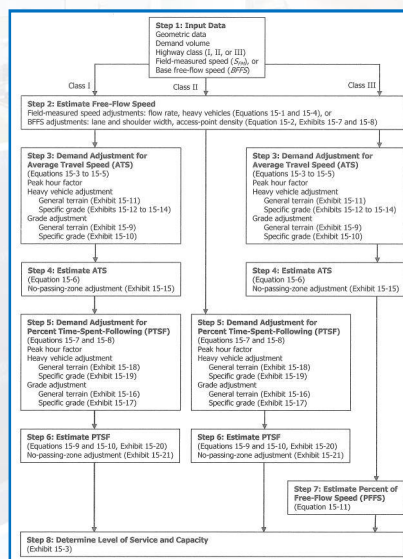
- Segments with signalized intersections
 - Streets module should be used to analyze isolated intersections
- Urban/suburban areas with multiple signalized intersections less than 2 miles apart
 - These situations should be analyzed using the Streets module
- Bicycle methodology adapted from urban & suburban data
 - Heavy vehicle percentages greater than 2%
 - Driver behavior factors may vary
 - Drivers slowing down for cyclists or drivers providing additional horizontal clearance while passing cyclists

233

Two-Lane Highways

Methodology

- HCM2010
- Exhibit 15-6



234

Two-Lane Highways

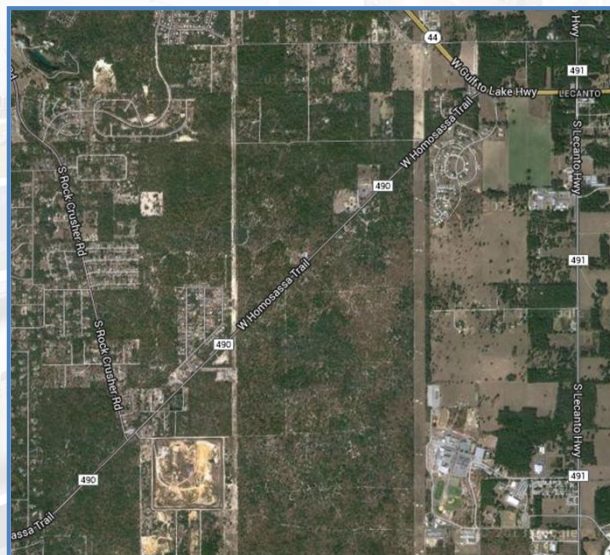
Example #12: SR 490 (Lecanto, FL)

- Level terrain
- 2 ft. shoulder width
- 12 ft. lane width
- 6.0-mile corridor length
- Class I highway segment
- 90% no passing zones
- 10 access points per mile
- 55 mph base FFS (50 mph posted)
- Pavement rating: 3

Analysis Direction Volume	444 vph
Opposing Direction Volume	296 vph
PHF	0.85
Trucks and Buses	6%

235

Two-Lane Highways



236

Two-Lane Highways

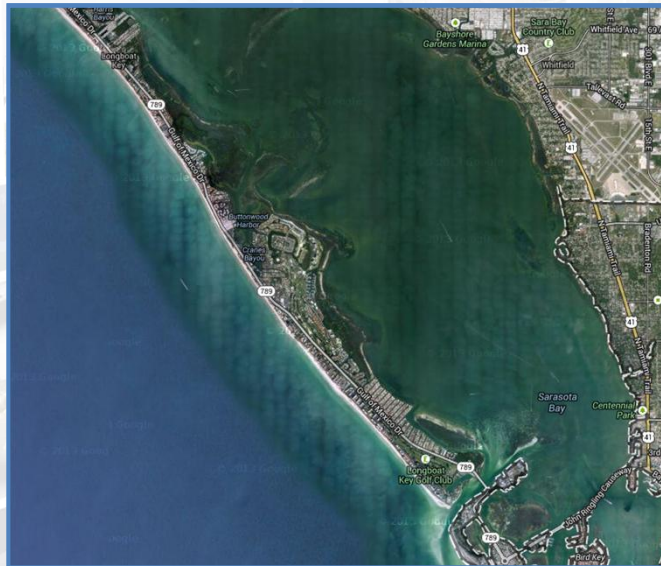
Workshop #26: SR 789 (Sarasota, FL)

- Level terrain
- 4 ft. shoulder width
- 11 ft. lane width
- 17.7-mile corridor length
- Class III two-lane highway segment
- 70% no passing zones
- 25 access points per mile
- 55 mph base FFS (50 MPH posted)
- Pavement rating: 4

Analysis Direction Volume	684 vph
Opposing Direction Volume	456 vph
PHF	0.90
Trucks and Buses	4%

237

Two-Lane Highways



238

Two-Lane Highways

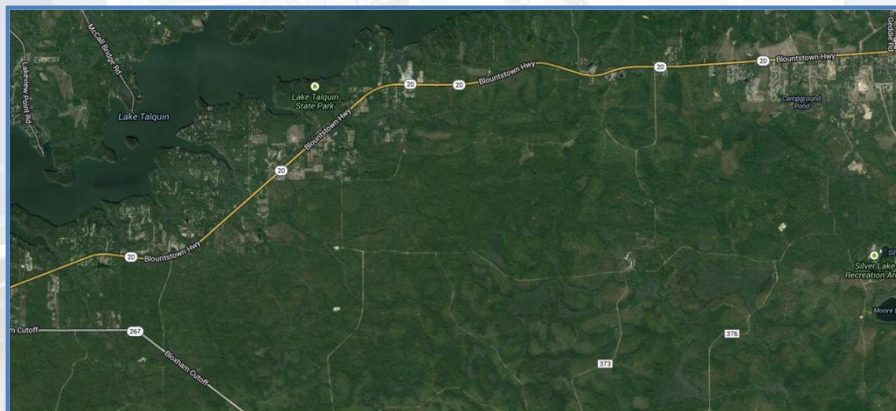
Workshop #27: SR 20 (Crawfordville, FL)

- Level terrain
- 6 ft. shoulder width
- 12 ft. lane width
- 14.5-mile corridor length
- Class II two-lane highway segment
- 62% no passing zones
- 13 access points per mile
- 60 MPH base FFS (55 MPH posted)
- Pavement rating: 4

Analysis Direction Volume	353 vph
Opposing Direction Volume	182 vph
PHF	0.88
Trucks and Buses	7%

239

Two-Lane Highways



240

Two-Lane Highways

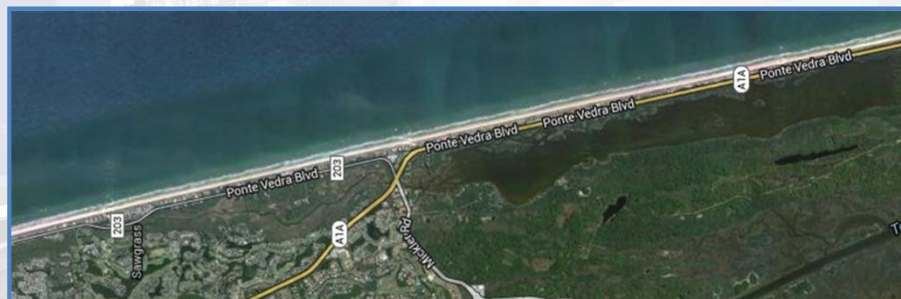
Workshop #28: SR A1A (St. Augustine, FL)

- Level terrain
- 2 ft. shoulder width
- 11 ft. lane width
- 15-mile corridor length
- Class III two-lane highway segment
- 80% no passing zones
- 25 access points per mile
- 55 MPH base FFS (50 MPH posted)
- Pavement rating: 3

Analysis Direction Volume	420 vph
Opposing Direction Volume	180 vph
PHF	0.90
Trucks and Buses	2%

241

Two-Lane Highways



242

Two-Lane Highways

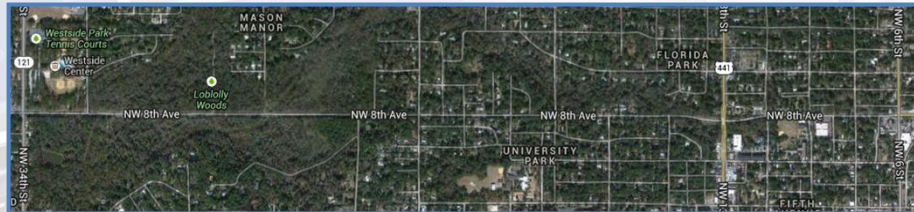
Workshop #29: 8th Avenue (Gainesville, FL)

- Rolling terrain
- 2 ft. shoulder width
- 11 ft. lane width
- 2.5-mile corridor length
- Class II two-lane highway segment
- 60% no passing zones
- 10 access points per mile
- 50 MPH base FFS (45 MPH posted)
- 15% occupied on-highway parking
- Pavement rating: 4

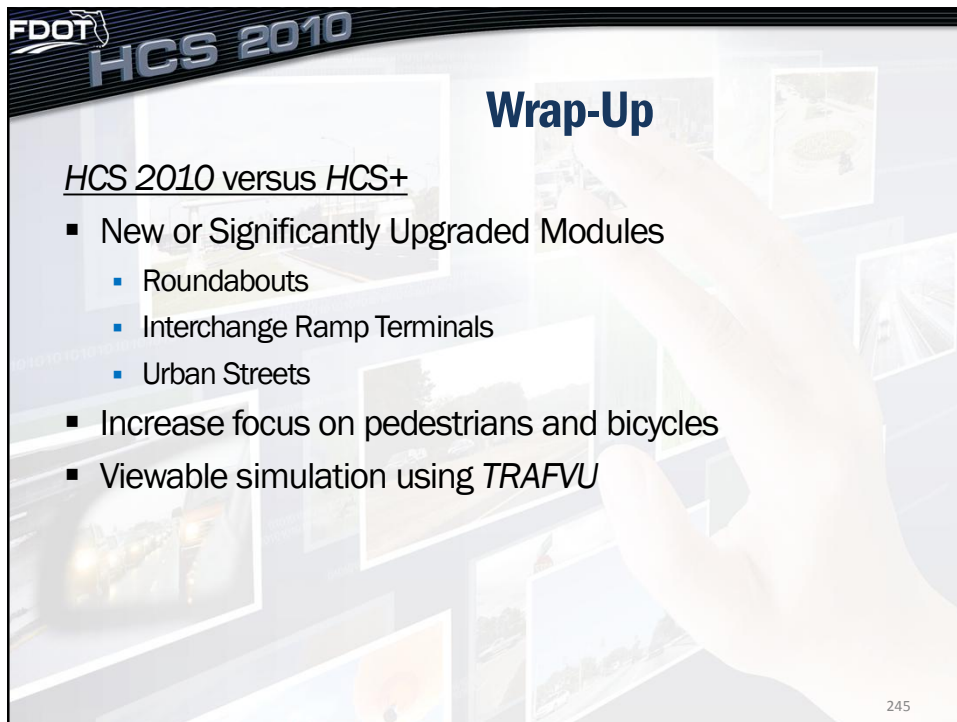
Analysis Direction Volume	630 vph
Opposing Direction Volume	270 vph
PHF	0.85
Trucks and Buses	3%

243

Two-Lane Highways



244



FDOT **HCS 2010**

Wrap-Up

HCS 2010 versus HCS+

- New or Significantly Upgraded Modules
 - Roundabouts
 - Interchange Ramp Terminals
 - Urban Streets
- Increase focus on pedestrians and bicycles
- Viewable simulation using *TRAFVU*

245



FDOT **HCS 2010**

Wrap-Up

Contact Information

- Tim White
 - tim.white@kimley-horn.com
 - (804) 672-4705
- Brian Smalkoski
 - brian.smalkoski@kimley-horn.com
 - (651) 643-0472

246